Coordinating Committee Request

1. **Tentative project title:** Quantification of best management practice effectiveness for water quality protection at the watershed scale
2. **Initial SDC proposal members:**
    a. Brian Benham, Associate Professor of Biological Systems Engineering, Virginia Tech, benham@vt.edu, 540-231- 5705
    b. François Birgand, Assistant Professor of Biological & Agricultural Engineering, North Carolina State University, birgand@ncsu.edu, 919-513-2499
    c. Theo Dillaha, Professor of Biological Systems Engineering, Virginia Tech, dillaha@vt.edu, 540-231-6813
    d. Prem Parajuli, Assistant Professor of Agricultural and Biological Engineering, Mississippi State University, pparajuli@abe.msstate.edu, 662-325-3282
3. **Draft SDC research objectives:**
    a. Develop and evaluate models for predicting the environmental and economic of effectiveness of best management practice (BMP) implementation at the watershed-scale.
    b. Develop and integrate new and/or improved BMP submodels into watershed scale models.
    c. Develop and integrate new and/or improved social, economic, and ecological submodels into watershed management models to improve ability to answer key watershed management questions.
    d. Improve and assess the ability of watershed management models to address issues such as climate change and emerging environmental pollutants.
    e. Develop methods to quantify modeling uncertainty as affected by model representations of watershed processes and model input data.
4. **Justification:**

Numerous studies have investigated the costs of watershed management activities needed to meet water quality goals. A good example is the Chesapeake Bay Watershed TMDL, which was completed in 2010 and which calls for annual reductions in nitrogen, phosphorus, and sediment of 25, 24, and 20%, respectively. Estimated costs of the required watershed improvement activities in the state of Virginia alone (one of 6 states in the watershed) are estimated to be on the order of $1.4 to $1.6 billion/year to the year 2021. Ninety percent of this funding is targeted for rural and urban watershed protection activities (agriculture, urban stormwater, and on-site wastewater disposal) requiring best management practices and watershed scale models for assessment. The remaining 10% of costs involve wastewater treatment system upgrades. If these costs are extrapolated across the nation to other legally mandated water quality improvement programs, the cost are well in excess of $100 billion/year for the foreseeable future. A major challenge with current models used for BMP assessment at the watershed scale is that in general, they poorly simulate BMP performance. Consequently there is considerable uncertainty in model predictions investments in water quality improvement activities almost always fail to achieve projected benefits. There are numerous limitations in the way that BMPs are simulated but two of the most critical are the inability of the models to realistically simulate the spatial placement of BMPs and the use of BMP effectiveness factors to represent the pollutant removal ability of many BMPs. BMP effectiveness parameters simply remove a portion of the pollutants from the flow affected by the BMP and they do not maintain mass balance and allow for the potential release of previously trapped pollutants with time. The proposed

Multistate Research Development Committee will develop a multistate research project proposal to develop solutions to overcome these and other problems associated with simulating BMPs at the watershed scale. This will enable watershed management decisions and investments to be made with less uncertainty and will improve the cost-effectiveness of watershed improvement activities.