Development of Geographic Information System (GIS) - Based Tool for Optimized Fluid Management in Shale Gas Operations

Research Objectives
The project objective is to develop a dedicated set of geographic information systems (GIS) based tools to address each important sector of fluids management in the oil and gas industry. The ultimate goal is to improve the current best practices in the water management segment of the shale oil and gas industry.

Accomplishments
The approach includes development and testing of multi-phase tools for water quantity and water quality modeling. The study investigates the data available to work with and its current validity. This was followed by extensive sampling and developing an in-field understanding of the various processes involved in the handling of fluids in the oil and gas industry, from drilling to water production and recycling. When it comes to mathematical modeling of the algorithms involved, the product was designed to work efficiently to address needs of the end-user to manage their water resources. These models are being built into a final comprehensive program.

Accomplishments
The work started with data collection, organization, and characterization. Various analyses were developed with time to analyze water quantity and water quality for different temporal aspects of the process. Analytical models were developed and corresponding journal articles were published to support the research. Based on the analyses done, tools are being developed to perform the above mentioned analytics in an automated way based on the user-generated data input. Tools were initially developed to work independent of each other. They are currently being tested with actual industry data to estimate accuracy and industrial benchmarking. The validation has proved that the tool is useful in day-to-day operations in the near future. The tools are integrated to work with each other to support the total lifecycle of water management in the oilfield.

A graphical user interface (GUI) was developed for three of the water use tools. The water use analytical tool takes operator input on water use and displays water use per well and per horizontal foot of well. Data from 84 wells has been entered to test the tool. The water production GUI outlines water produced over the lifetime of the well and can be used to predict quantities of water for future management. The water quality prediction tool will take operator parameters and predict water quality based on the age of the well. This tool is being developed to help operators plan for water reuse based on the quality coming out of the wells.

Future Plans
Water treatment options will also be outlined in the tool to account for iron removal, TDS reduction and softening as needed. There are plans to beta test the tool through NETL ORD.