Examination of Potential Factors Affecting Successful Exploration and Production of Devonian Marcellus Shale Gas, Eastern United States*

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The Devonian Marcellus Shale is one of several, very high profile shale gas plays in the United States and is the most significant new play in the Appalachian Basin in several decades. The following key factors will probably determine whether or not this play will develop into a natural gas resource that meets national expectations:

(1) The volume of economically extractable resources. Assessments of the amount of undiscovered, technically-recoverable gas vary and depend on the effectiveness of horizontal drilling and multi-stage hydraulic fracture stimulation. Estimates of undiscovered, technically recoverable natural gas range from 0.8 to 3.7 trillion cubic feet by the U. S. Geological Survey (USGS) in 2002 to more than 100 times these amounts by industry consultants in 2008.

(2) The availability of sufficient fresh water for drilling, stimulation, and completion of the wells. Current shale gas well designs call for use of three to nine million of gallons of fresh water per well to attempt a successful completion. Given the number of forecasted wells necessary to extract the resource, there is concern that there will not be enough fresh water available for the work.

(3) The capacity for effective disposal or reclamation of post-completion drilling and completion fluids and solids. All of the material pumped into the reservoir that is recovered back to the surface must be disposed or recycled. Currently, there is inadequate capacity to handle this flow-back material properly at the scale planned for full development.

(4) The potential for significant wildlife habitat fragmentation caused by drill pad density and gathering, compression, and pipeline facilities. In areas of large, contiguous habitat, the activities associated with well-site construction, maintenance, and production activities may produce unintended consequences with respect to forest health and invasive species.

With collaborators, the USGS is studying the relative importance of these factors and the role that they may play in the evolution of the Marcellus Shale gas play so that we can meet our mission obligation to improve the nation's understanding of ecosystems and resources. Proper and prudent planning with foresight to managing the entire natural resource base will be necessary if the Marcellus

shale gas play will reach its stated potential. The first steps in this planning effort involve examining and understanding the baseline conditions of these four factors.