Using Geophysical Data to Improve an Optimization Groundwater Model Evaluating the Effectiveness of Intentional Recharge in the North Platte River Valley, Western Nebraska, U.S.A.

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Intentional recharge to groundwater from surface water irrigation systems has been selected as a priority tool for water management in the North Platte River Valley of western Nebraska. Optimization groundwater models (GWM) of the area were constructed by the U.S. Geological Survey (USGS) in order to evaluate the effectiveness of intentional recharge as a management tool. Concerns over the regional scale of available data used for the hydrogeologic framework being used to evaluate local conditions led to construction of 2 hydrogeologic frameworks for the model area- one framework from a previously constructed regional model using traditional point data, such as lithology logs, borehole geophysics, and aquifer tests and the second framework, refined from the original, with high density airborne and surface geophysical data. Airborne electromagnetic (AEM) surveys provide densely sampled data over large areas (typically several hundred sq. km) that cannot be covered effectively using ground-based methods. After inversion, resistivity structures are interpreted to make inferences about hydrogeologic properties and processes. Capacitively coupled resistivity (CCR) surveys give details of the electrical properties in the near surface. When calibrated to infiltration and lithologic data, CCR accurately predicts infiltration along hundreds of km of irrigation canals, and was used to refine GWM inputs. The original

geologic framework in the GWM was replaced with the framework refined using AEM, greatly improving the GWM performance by providing a new understanding of groundwater flow rates and pathways. Future model refinement will use data from Nuclear Magnetic Resonance (NMR) measurements which provide information directly about the porosity and hydraulic conductivity. The techniques of AEM and CCR allow a new direction for geoscientists to follow to provide more accurate frameworks for input into GWM. Using these quantitative tools to more accurately describe the natural system, resource managers will gain improved insight and confidence in resource management.