Preliminary Results from Helicopter Electromagnetic Surveys Over a Paleovalley Aquifer in Eastern Nebraska

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Preliminary Results

2009 HEM Surveys at Swedeburg and Crete-Princeton-Adams Sites

Relevance to Water in Nebraska

- Seventy percent of Nebraska’s water is in eastern Nebraska where groundwater resources are limited.
- Much of the groundwater supply in eastern Nebraska is in Paleovalley aquifers within and below glacial deposits. These aquifers can be laterally discontinuous and are separated from the High Plains Aquifer that supplies water resources to western Nebraska.
- The Paleovalley aquifers have highly variable geology and are hydrologically heterogeneous.
- Delimitation of Paleovalley aquifers is critical for management purposes. Contamination to the surface may diffuse into these aquifers and degrade their water quality. The quantity of water may also be limited due to the spatially confined nature of Paleovalley sediments.

Project History

Helicopter Electromagnetic (HEM) surveys were conducted at three pilot study sites in 2007 to evaluate mapping technologies in a variety of glacial terrains. These surveys showed:

- The main limitation in depth of mapping for HEM applications is controlled by the amount of soil or clay in the glacial till overburden.
- Shallow bedding (less than 2 meters) and gravel aquifers can be imaged in greater detail than possible using available registered well information and is more cost-effective than a test hole drilling campaign.

Swedeburg HEM Resistivity Maps

This map shows the apparent resistivity of the subsurface as measured at 0.3 kHz. The survey area is 76 by 140 km (30 by 55 miles). Red and pink areas have high resistivity and generally indicate sand and gravel. Blue areas have low resistivity and generally indicate clay or silt. Paleovalley sites are identified with red star symbols. Paleovalleys are present on the east side of the field area. The magnitude of the flight area shows that the paleovalleys are considered discontinuous sand patches that floor the glacial terrain of this area and render water supply development and management difficult.

Preliminary Results

- Aquifers and aquifer systems can be mapped in greater detail using helicopter electromagnetic surveys.
- Certain hydrostratigraphic features such as buried conduits, paleovalleys and cultural features can be identified.
- The interpretation of buried hydrogeologic features such as buried conduits, paleovalleys and cultural features can be highly variable.

Project Partners

- U.S. Geological Survey
- Conservation and Survey Division (University of Nebraska)
- Lower Platte South Natural Resources District
- Lower Platte North Natural Resources District
- Nebraska Environmental Trust

Swedeburg Area viewing Todd Valley to the northeast

Crete-Princeton-Adams Paleovalley Aquifer Site

- The groundwater system in eastern Nebraska is dominated by Paleovalley sediments, which can be mapped using helicopter electromagnetic surveys.
- The Paleovalley aquifer system is spatially incomplete and lateral discontinuities can create development and management challenges.

Swedeburg-Princeton-Adams Paleovalley Site

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