DNR MEMO

April 27, 2004

TO: File

FROM: Kevin J. Schwartman, P.G.

SUBJECT: Republican River Compact Alluvial Mapping Project - Summary

This memo describes the methods by which I defined the alluvial aquifer in the Republican River basin. It is a summarized version of a previous report, which does not include descriptions of well logs and the cross-sections I made to help me define the alluvial boundaries.

The purpose of this project was to update the alluvial boundary of the Republican River valley using new software and data. The alluvial boundary, which outlines the area where wells draw water from Quaternary-aged alluvial fill, is of interest because it can be useful in terms of the Republican River Lawsuit settlement.

The criteria used by DNR staff member Mike Thompson to define the original alluvial map were based on Attachment B to the 1997 Republican River Engineering Committee Report. Attachment B states that "only wells that were drilled within the approved mapped boundaries of the alluvial-fill formation and that derived some or all the pumped water from the alluvial-fill formation at the time the well was drilled should be considered as pumping from the alluvium for (the Republican River) Compact purposes. The alluvial-fill formation is defined as the area of unconsolidated, detrital material of the Quaternary Period that yields sufficient water for a well and that is within the erosional depression bounded by bedrock that does not yield sufficient water for a well, elevated river terraces, escarpments or gentle topographic highs" (Thompson, M., Republican River Compact Alluvial Mapping Project: Memo from September 30, 1997).

Information used to edit the alluvial boundary includes irrigation well data (location and well log information), SSURGO soils, thematic mapper (30 meter multi-spectral satellite imagery), 3% slopes, and DRGs (digital raster graphics/USGS 1:24000 scale topographic maps). I also used a digital version of the Bedrock Geology Map of Nebraska (Burchett, R.R., 1986), a digital test-hole location map and test-hole log reports (all from the UNL Conservation & Survey Division). Additional data and well log information came from the Ground Water Database of the Department of Natural Resources website

(http://www.dnr.state.ne.us/). The Groundwater Database is located at: (http://dnrserver26.dnr.state.ne.us/wells/wellsindex.asp).

The two well files used for this project were the **Wells.shp** and the **Rep_Reg_Wells.shp** well files. Both include only wells located within the Republican River valley. **Wells.shp** includes only the irrigation wells within the Republican River valley and was created for this project. The other well file called **Rep_Reg_Wells.shp,** includes all wells (including commercial, domestic, public...etc) and was created from the 1995 Registered well file (**wells_00.shp**) by removing all of the wells located outside of the Republican River valley. It includes some of the same well data as the **Wells.shp** file, but many of the well locations do not match up either on the map or by legal description. I made adjustments to the alluvial well files to include both well locations in areas where one well appeared in two separate places on the map (hopefully in a way that makes sense lithologically and topographically).

In many areas, I used irrigation well logs to create a series of geologic cross-sections and "sheets" (well logs and short geologic cross-sections) to determine if the boundary should be extended, adjusted, or what parts were to be removed. The geologic cross-sections are based on well locations from the Republic River valley well file (**Wells.shp**). Due to the inaccuracies in the locations as described earlier, it is possible that the distance between wells, the approximate topography, and even the well placement may be off by a short distance. But the lithology and correlative relationships should not be affected and are still useful in determining the generalized subsurface geology of the area.

In determining which wells were to be included within the alluvial boundary, I chose wells that were similar in lithology to those within a mile to 1.5 miles of the Republican River. Nearby wells with similar lithology would most likely have been deposited in a similar depositional environment, the same conditions would have been in place when the alluvium was deposited at both sites. So wells located in the same area deposited in the same environment would, most likely, both be part of the same alluvium. Wells located near tributaries of the Republican River were treated the same, those within 2000 feet of the nearest tributary that had a similar lithology to wells within the alluvial boundary were included and the boundary was adjusted to include these wells if necessary.

Tributaries that flow over the Ogallala group, such as along Frenchmen Creek, were more difficult to determine as some of the alluvium could be similar to the lithology of the Ogallala Group. County test hole logs published by the UNL Conservation and Survey Division were helpful in separating the alluvium from the Ogallala sediments. I found that the wells in these areas were drilled and screened below the alluvium into the Ogallala. So the source of water for these wells was the Ogallala Aquifer, not the alluvial aquifer.

Some wells appeared to have similar lithology but were located in areas that were much higher in elevation than those wells within the

alluvial boundary, they were also over 2000 feet from the nearest tributary. I often used DRGs (Digital Raster Graphics or digital topographic maps that are 1:24000 scale from the US Geological Survey) to try to separate alluvial wells from those that may be similar in lithology, but are from a different source. I left out wells that were drilled in topographically high areas that would probably have come from a depositional environment that was different from the alluvial aquifer. Some wells that were located along topographic high spots were included if the elevation was not too great and if the well was located within 2000 feet of the nearest tributary. If the well was located over 2000 feet from the tributary I considered that to be too great a distance to have been deposited in the same environment.

So the placement of the alluvial boundary was based mostly on the depositional environment of the alluvium in the well. If it was the same wells already included within the alluvial boundary the boundary was adjusted to include that well and the surrounding area. The lithology of the well was most important with other factors taken into consideration such as screening depth, elevation and distance from the Republican River and its tributaries.

Two Geographic Information System or GIS software programs were used to compare the well data, ArcView 3.2 and ArcMap 8.1 (Environmental Systems Research Institute, Inc). Most of the data were assembled and compared using ArcView 3.2 using extensions and tools created by Jeff Shafer. Topographic maps (DRGs) and the well data were easier to access using the tools from these extensions. I was unable to edit the new alluvial boundary shapefile using ArcView 3.2 (map name: republicanalluvium.apr), but could make changes in the alluvial boundary using ArcMap 8.1 (map name: RepublicanRiver_Alluvium.mxd). I could also access the geologic bedrock map and test hole (point) coverages on ArcMap, but through most of this project, these two coverages could not be accessed in ArcView due to differences in the way the data were projected. I later converted the coverages to shapefiles so I could access them in ArcView 3.2. All the data were converted to shapefiles and copied to a CD.

The original memo includes notes that I took describing what areas of the old alluvial boundary were edited and the reasons what wells were added or removed. Following the notes is a list of references, mostly county test-hole Log reports from the UNL Conservation & Survey Division. This is followed by a list of the topographic maps (DRGs). The last part of this memo is a list of various shapefiles associated with this project. Not all of the test-hole reports, DRGs or shapefiles listed toward the end of this memo were necessarily used for this project.

In summary, this map represents an interpretation of the alluvial aquifer based on the data available. This map may not be completely finished, as more data become available; updates can be made to the current version of this alluvial boundary map as necessary.