Agenda Item: 13

Memorandum

To: Papio-Missouri River Natural Resources District Programs Projects and Operations Subcommittee

From: Paul W. Woodward, PE, Groundwater Management Engineer

Date: July 5, 2016

Re: Review and Recommendation on the Water Sustainability Fund Application for the Western Sarpy County Aquifer 3D Modeling Project

---

In April, the District was awarded a Water Sustainability Fund Grant to collect Airborne Electromagnetic Survey (AEM) data of Southwestern Sarpy County. In May, the District approved a contract with Aqua Geo Frameworks to perform the survey, interpret the data, and provide final digital data along with a report of the findings. This AEM survey area as shown in Figure 1 will likely be flown in August with results coming back to ENWRA and the District by June of 2017.

This AEM survey is expected to provide enough detailed data of the potentially isolated Dakota aquifer in this area that a complete extent and volume can be created. This particular aquifer has been under increasing demand as a drinking water supply, yet has seen areas of high nitrates during water quality testing, see Figure 2 attached. Many of the existing domestic wells have screens near the bottom of the aquifer since it is fairly shallow (between 100' and 200'), but it is anticipated that nitrate contamination near the upper portion of the aquifer may eventually cause concerns. Actually knowing and mapping the extent and volume of this aquifer would provide great management benefits. For example:

- Each well can be mapped in relation to the actual depth of the aquifer. This may encourage owners to drill their well deeper if problems arise.
- New wells can be constructed in better ways to avoid potential issues.
- Recharge of groundwater from the surface can be better understood and managed.
- Water quantity issues can be mapped within the aquifer.

These options for management are enhanced with the AEM data, however, much additional effort is needed to map and understand each wells location and depth as well as where impaired groundwater quality may be an issue. The best tool to accomplish this would be to create a 3D model of the aquifer, including all available well data and water quality results. In cooperation with District staff, the USGS has prepared the attached draft scope of work and cost estimate to create such a 3D model using all available information.

The proposed project would take place in the NRD's fiscal years of FY 18 and 19, following our receipt of the new AEM data next June. Based on this timing, the District has the opportunity to submit a Water Sustainability Fund grant application by July 31, 2016 and hopefully secure this funding for the project before next June. Therefore, the USGS and District staff are jointly preparing a Water Sustainability Fund application to help support the continuation of this mapping and aquifer management project. The grant application breaks down the funding as follows:

AGENCY	PMRNRD FY 17-18 (July 2017-June 2018)	PMRNRD FY 19 (July 2018-June 2019)	Totals
WSF	$117,960	--	$117,960
PMRNRD	$15,815	$62,825	$78,640
USGS	$66,100	$11,600	$77,700
Totals	$199,875	$74,425	$274,300

The USGS is uniquely qualified to perform this project as the 3D modeling software, known as GeoScene 3D, which incorporates the AEM data is produced and licensed by a company in Denmark which is working directly with USGS. This same software is being considered by UNL-CSD to house all of the AEM data that is being collected statewide. The final product will allow the District to add additional data as time goes on to better understand the water quality and quantity issues within the aquifer.

Staff recommends that the subcommittee recommend to the Board of Directors that the General Manager be authorized to execute and submit a Water Sustainability Fund application in the amount of 60% of eligible costs for the Western Sarpy County Aquifer 3D Modeling Project, with the understanding that the U.S. Geological Survey will be contracted to perform the project under a future Joint Funding Agreement, subject to changes deemed necessary by the General Manager and approval as to form by District Legal Counsel.

FIGURE 1. AEM Survey Area and Flight Lines

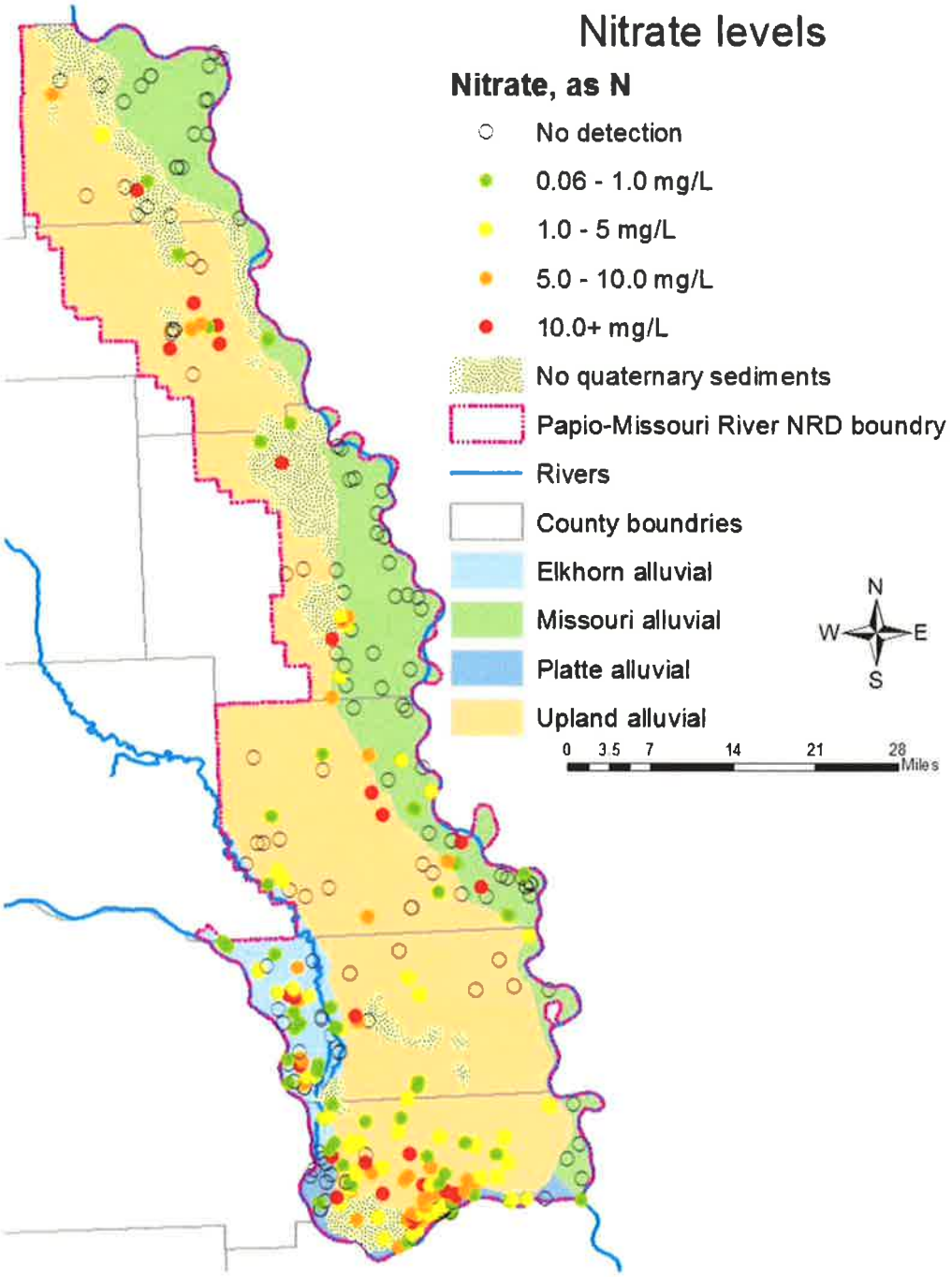

Figure 2. Wells sampled from 1992-2013 (Produced by USGS 2015)

Title: GeoScene 3D aquifer characterizations of Western Sarpy County, and isopach map of the Dakota Aquifer in southwest Sarpy County

Amanda Flynn, US Geological Survey Nebraska Water Science Center

Purpose and Scope: The population of Sarpy County has been increasing steadily since 1940. As of 2005, about half of the population lives in urban areas that receive municipal water, and the other half obtain their water through domestic wells. Domestic well installations have been increasing steadily in areas that had previously been used for agricultural purposes. Sampling of these new wells has shown elevated nitrate levels, and some areas have nitrates above the EPA MCL. The geologic system in this area is complex and has not been mapped in detail. The extent and volumes of the aquifers being utilized for new domestic supply is unknown.

The Papio-Missouri Natural Resources District needs to better understand the aquifer extents and thicknesses within Sarpy County to understand the resource and decide on management plans, both for capacity and use. The District has been collecting many different types of data, but the data has not been compiled into a single project for a complete understanding of the complex system. A GeoScene 3D project of western Sarpy County would fill that void. GeoScene 3D is a graphical 3D interface which would allow the managers to visualize the aquifers, the placement of wells within the aquifers and the connections of the aquifers with the land surface and to each other. GeoScene 3D allows for the import of airborne electromagnetic (AEM) data, in addition to borehole logs and hand-drawn cross sections, to interpolate the aquifer properties from multiple sources. Once the data is uploaded into the project, interpolated and revised, the layers can be exported from the program to make maps. The Dakota aquifer in Sarpy County has not been previously mapped in detail. The aquifer is being utilized by more domestic users in the past 15 years, and is also impacted by high nitrates. Publishing an isopach map of the thickness of the Dakota Aquifer in southwest Sarpy County will aid stakeholders in understanding the extent and possible limitations of the resource.

Approach: Construction of the GeoScene 3D project will require compilation of all geologic data collected within the county. Geologic data includes AEM data, published cross sections, registered well logs, testhole logs, and unregistered well logs. AEM data will be provided by ENWRA and the District. Published cross sections will be collected from the University of Nebraska, School of Natural Resources, Conservation Survey Division. Registered well data will be collected from the Nebraska Department of Natural Resources. Unregistered well data (wells where no water was found, or wells that did not meet the criteria of registration at the time of development) have been collected by many drillers by the ENWRA group and provided to the USGS. Drillers that had not been previously approached for their information will be contacted for this effort. All data will be reviewed by a geologist and categorized based on stratigraphic unit and aquifer property (aquifer material or aquitard). This categorization will help the District managers visualize the connections between land surface and the various aquifers. After the GeoScene project has been constructed, the top and bottom surfaces of the Dakota Aquifer will be exported from the project and an isopach map of the thickness of the Dakota Aquifer will be generated.

Products: The GeoScene 3D project will be provided to the NRD as a tool for managers to use to understand the aquifers within the county. A USGS Open-File Report (OFR) will be written, explaining the data used to create the project, how to use the project as a tool to understand the resource, and the limitations of the project. Additionally, a USGS Scientific Investigations Map (SIM) will be generated documenting the thickness of the Dakota Aquifer in southwest Sarpy County. A shapefile of the top and bottom elevation of the Dakota Aquifer and associated metadata will be released with the SIM.

Timeline:

		2017												2018							
		May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Data Collection																					
DNR well classification	Flynn	x	x	x	x	x															
	Traylor/Kavan			x	x																
Existing ENWRA wells-	Flynn				x																
	Traylor/Kavan		x	x	x																
Unregistered well logs-	Flynn				x	x															
	Traylor/Kavan	x	x	x	x																
GeoScene																					
Model Build	Flynn						x	x	x	x	x										
	Traylor						x	x													
OFR review and publication	Flynn										x	x	x	x	x	x	x	x	x		
Dakota Isopach Map																					
Contouring	Flynn											x	x	x							
	Traylor										x	x									
SIM review and publication	Flynn													x	x	x	x	x	x	x	x
	Kavan																	x	x		

Estimated Budget:

Federal Breakout	FFY17	FFY18	FFY19	Total
USGS Cost	$ 21,600	$ 44,500	$ 11,600	$ 77,700
WSF	$ 30,160	$ 66,800	$ 21,000	$ 117,960
PMRNRD	$ 20,140	$ 44,500	$ 14,000	$ 78,640
Total	$ 71,900	$ 155,800	$ 46,600	$ 274,300

	PMRNRD FY 17-18 (May 2017-June 2018)	PMRNRD FY 19 (July 2018-June 2019)	Totals
WSF	$117,960	--	$117,960
PMRNRD	$15,815	$62,825	$78,640
USGS	$66,100	$11,600	$77,700
Totals	$199,875	$74,425	$274,300

	PMRNRD FY17 Q4 (May-Jun 2017)	PMRNRD FY18 Q1 (July-Sep 17)	PMRNRD FY18 Q2 (Oct-Dec 17)	PMRNRD FY18 Q3 (Jan - Mar 18)	PMRNRD FY18 Q4 (Apr-Jun 18)	PMRNRD FY19 Q1 (Jul-Sep 18)	PMRNRD FY19 Q2 (Oct - Dec 18)	
PMRNRD + WSF	$ 20,120	$ 30,180	$ 27,825	$ 27,825	$ 27,825	$ 27,825	$ 35,000	$ 196,600

Sarpy County GeoScene3D Project

	FY17	FY18	FY19	Total
Salaries	$31,300	$63,800	$15,800	**$110,900**
Overtime	$0	$0	$0	**$0**
Travel	$0	$1,800	$0	**$1,800**
Vehicles	$100	$100	$100	**$300**
Training	$0	$1,000	$0	**$1,000**
Equipment	$0	$0	$0	**$0**
Supplies	$1,900	$2,000	$2,100	**$6,000**
Other Cost Center	$0	$0	$0	**$0**
Contracts	$0	$0	$0	**$0**
USGS Labs	$0	$0	$0	**$0**
non-USGS Labs	$0	$0	$0	**$0**
Shipping	$0	$0	$0	**$0**
Publications	$0	$6,600	$6,900	**$13,500**
SV & Miscellaneous	$0	$0	$0	**$0**
Total (without Leave or Contingency)	$33,300	$75,300	$25,000	**$133,600**
CONTINGENCY FACTOR	$1,700	$3,800	$1,200	**$6,700**
DIST. TRAINING & MISC PROJ TIME FACTOR	$0	$0	$0	**$0**
LEAVE FACTOR	$5,600	$11,500	$2,800	**$19,900**
PROJECT EXPENSES	*$40,600*	*$90,500*	*$29,100*	**$160,200**
SCIENCE SUPPORT	*$0*	*$0*	*$0*	**$0**
BASIS + NET FUNDING REQUIREMENT	**$40,600**	**$90,500**	**$29,100**	**$160,200**
COST CENTER	*$21,600*	*$44,600*	*$11,600*	**$77,800**
FACILITIES	*$4,200*	*$8,600*	*$2,200*	**$15,000**
BUREAU	*$5,600*	*$12,100*	*$3,600*	**$21,300**
BASIS+ INDIRECT COSTS Subtotal	*$31,400*	*$65,200*	*$17,500*	**$114,100**
BASIS + GROSS	*$72,000*	*$155,800*	*$46,500*	**$274,300**
AUGMENTATION REDUCTION	*$0*	*$0*	*$0*	**$0**
TOTAL INDIRECT COSTS (INCLUDES SS)	*$31,400*	*$65,200*	*$17,500*	**$114,100**
ESTIMATED TOTAL PROJECT REQUIREMENTS	**$72,000**	**$155,800**	**$46,500**	**$274,300**

USGS Cooperative Matching Funds	**$21,600**	**$44,500**	**$11,600**	**$77,700**
Cost to the PMRNRD	**$20,140**	**$44,500**	**$14,000**	**$78,640**
Cost to the WSF	**$30,160**	**$66,800**	**$21,000**	**$117,960**

Task	Staff	Rate (SS/day)	FY17	FY18	FY19	Total	LABOR COST
Data Collection							
DNR well classification	Geologist	$ 399	12	0	0	12	$ 4,788
	Generic-9/11	$ 285	20	0	0	20	$ 5,700
Existing ENWRA wells-locate and classify	Geologist	$ 399	5	0	0	5	$ 1,995
	Generic-9/11	$ 285	15	0	0	15	$ 4,275
Unregistered well logs-locate and classify	Geologist	$ 399	15	0	0	15	$ 5,985
	Generic-9/11	$ 285	30	0	0	30	$ 8,550
GeoScene							
Model Build	Geologist	$ 399	0	45	0	45	$ 18,754
	Generic-9/11	$ 285	0	10	0	10	$ 2,977
Admin Report-writing and publication	Geologist	$ 399	0	45	2	47	$ 19,625
Dakota Isopach Map							
Contouring	Geologist	$ 399	0	11	0	11	$ 4,584
	Generic-9/11	$ 285	0	10	0	10	$ 2,977
SIM review and publication	Geologist	$ 399	0	35	30	65	$ 27,645
	Generic-9/11	$ 285	0	5	5	10	$ 3,043
TOTAL							$ 110,898