

Agenda Item: 6.

## Memorandum

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

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

**Date:** June 8, 2015

**Re:** Ashland Area Pilot Groundwater Model Update and Report

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This item was tabled at the May 14<sup>th</sup>, 2015 Board of Directors meeting to request additional information regarding the sole-sourcing of this model and report to the U.S. Geological Survey (USGS) and the importance of the study outcomes to the District.

First, the District has previously entered an agreement with U.S. Geological Survey to complete an initial version of this Pilot Groundwater Model for a portion of the Platte River valley near Ashland, Nebraska (see Attachment 1). USGS was and still is the only organization capable of producing this particular Pilot Groundwater Model because experts at USGS developed the cutting-edge technology and science necessary for the fully-coupled surface and groundwater model, known as the Farm Process. This project is consistent with USGS's requirements not to compete with private-sector business and to only participate with local agencies on projects where their staff is at the forefront of science and technology leading to unique scientific advancement or issues which represent a federal interest.

The cost for this initial modeling was \$147,950. Through prior interlocal agreement, both Lower Platte NRD's and ENWRA each contributed \$10,000 toward the cost of the initial pilot model. USGS also committed cooperative water program funding in the amount of \$39,975 (~27%). The P-MRNRD funded the remaining \$77,975 (~53%) of the initial modeling costs.

The extent of this surface and groundwater model is an area of significant importance to the entire Lower Platte River Basin. The model includes areas currently considered hydrologically connected to the Platte River in which potential changes in water management or landscape have the ability to influence the flow in the river, or vice versa. Impacts to groundwater and surface water resources in the area have the potential to affect municipal well fields that provide a significant portion of potable water to over half of Nebraska's population. Future abilities to meet the needs of these municipal water supplies have the potential to restrict other water uses across much of Nebraska in times of drought; and therefore, it will be of upmost importance to understand the various management or project options that may mitigate these impacts.

The currently completed pilot model provides the NRDs and ENWRA with advanced tools and a greater understanding of the alluvial system than that available with more standard approaches. In particular, data from the model in its current state can:

- Predict groundwater flow direction, velocity and timing. This is important in evaluating opportunities and benefits from conjunctive water management policies or projects developed as part of our IMP or the Lower Platte River Basin Water Management Plan.
- Ongoing evaluations by the Nebraska Department of Natural Resources in determining Fully Appropriated Basins benefit from more detailed data and can be more thoroughly reviewed against the model.
- Existing models for the municipal well fields and Mead groundwater remediation project can be assisted by a fully-coupled surface and groundwater model which can better provide breakdowns of the entire water cycle, including precipitation, evapotranspiration, runoff, groundwater recharge and uses.

In order to further develop the model and its capabilities, USGS is proposing to complete a full update of the pilot model and publish a Scientific Investigations Report for the study over the course of the next three years, see attached Proposal and USGS Joint Funding Agreement. The primary benefits and outcomes of completing the model update and report include:

- Ability to model various river flow scenarios in the Platte which will yield significant data for drought planning and efforts of the LPRBWMP. Expansion of the simulation period through 2014 also allows analysis of the 2012 drought which severely affected flows in the Platte River.
- The fully-coupled simulation will investigate overall irrigation efficiency and provide information regarding the effects of various management activities on hydrologically connected water resources.
- Updated land use information and documentation of newly-collected geologic data will improve model inputs and calibration.
- Improved information for the municipal well fields located in the study area under specific water-management changes.
- A complete report which fully documents the unique methodologies and outcomes of this model as compared to separate surface water and groundwater modeling systems.
- Improved data to assist or review the Annual Evaluation of Availability of Hydrologically Connected Water Supplies, completed by the Nebraska Department of Natural Resources (Department).

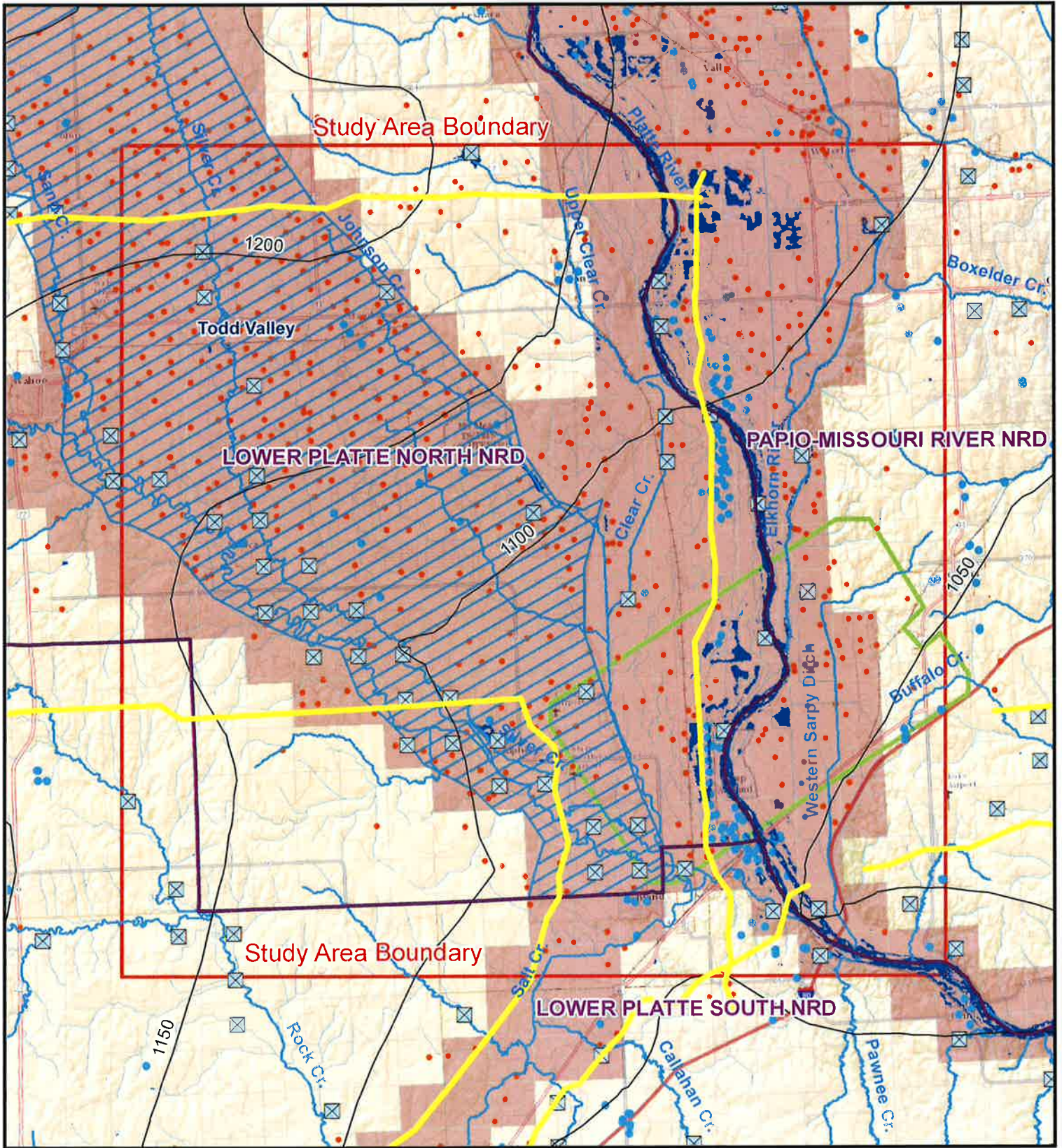
In order to update the model and complete a report, it is proposed that the District enter into a Joint Funding Agreement with USGS for a total cost of \$336,900. USGS would provide cooperative water program funding in the amount of \$113,000 (~34%), the remaining non-federal share of \$223,200 would be paid to USGS by the District after receiving payments from other local partners.








It is proposed that the non-federal share of the cost for completion of the pilot model would again be a cooperative effort involving the District, the Lower Platte South and Lower Platte North NRDs, and ENWRA. As such, an Interlocal Agreement with the Lower Platte NRD's has been prepared for the study and is attached for consideration. The total project cost and the agency contributions are listed in the following table. The costs amongst the three NRD's and ENWRA would be equally divided over our next three fiscal years, amounting to \$11,160 each year for LPSNRD, LPNNRD, and ENWRA and \$40,920 per year for the P-MRNRD.

Agency	Cost
USGS	\$113,700
LPSNRD	\$33,480
LPNNRD	\$33,480
ENWRA	\$33,480
P-MRNRD	\$122,760
Total	\$336,900

**Staff recommends that the subcommittee recommend to the Board of Directors to remove item from the table and that the General Manager be authorized to execute the proposed Joint Funding Agreement with the USGS for a maximum contribution of \$223,200 and the proposed interlocal agreement with Lower Platte South and Lower Platte North NRDs for the Ashland Area Pilot Groundwater Model Update and Report, subject to changes deemed necessary by the General Manager and approval as to form by District Legal Council.**

# Attachment 1



- |   |                             |   |                          |
|---|-----------------------------|---|--------------------------|
|   | Natural Resources Districts |  | Hydrologically Connected |
|  | Registered Wells            |  | Ashland HEM Area         |
|  | Municipal Wells             |  | New AEM Data             |
|  | SW Appropriations           |   |                          |



Form 9-1366  
(Oct. 2005)

**U.S. Department of the  
Interior  
U.S. Geological Survey  
Joint Funding Agreement**

Customer #: 6000000134  
Agreement #:  
Project #:  
TIN #: 47-0542469  
Fixed Cost Agreement  Yes  No

**FOR  
WATER RESOURCES INVESTIGATIONS**

THIS AGREEMENT is entered into as of the 1st day of June 2015 by the U.S. GEOLOGICAL SURVEY, UNITED STATES DEPARTMENT OF THE INTERIOR, party of the first part, and the PAPIO-MISSOURI RIVER NATURAL RESOURCES DISTRICT, party of the second part.

1. The parties hereto agree that subject to availability of appropriations and in accordance with their respective authorities there shall be maintained in cooperation **Ashland Integrated Model Phase 2**, herein called the program. The USGS legal authority is 43 USC 36C; 43 USC 50; and 43 USC 50b.
2. The following amounts shall be contributed to cover all of the cost of the necessary field and analytical work directly related to this program. (b) includes In-Kind Services in the amount of \$0.
  - (a) \$113,700 by the party of the first part during the period  
June 1, 2015 to December 31, 2017
  - (b) \$223,200 by the party of the second part during the period  
June 1, 2015 to December 31, 2017
  - (c) Additional or reduced amounts by each party during the above period or succeeding periods as may be determined by mutual agreement and set forth in an exchange of letters between the parties.
  - (d) The performance period may be changed by mutual agreement and set forth in an exchange of letters between the parties.
3. The costs of this program may be paid by either party in conformity with the laws and regulations respectively governing each party.
4. The field and analytical work pertaining to this program shall be under the direction of or subject to periodic review by an authorized representative of the party of the first part.
5. The areas to be included in the program shall be determined by mutual agreement between the parties hereto or their authorized representatives. The methods employed in the field and office shall be those adopted by the party of the first part to insure the required standards of accuracy subject to modification by mutual agreement.
6. During the course of this program, all field and analytical work of either party pertaining to this program shall be open to the inspection of the other party, and if the work is not being carried on in a mutually satisfactory manner, either party may terminate this agreement upon 60 days written notice to the other party.
7. The original records resulting from this program will be deposited in the office of origin of those records. Upon request, copies of the original records will be provided to the office of the other party.

Form 9-1366  
continued

U.S. Department of the Interior  
U.S. Geological Survey  
Joint Funding Agreement

Customer #: 6000004539  
Agreement #:  
Project #:  
TIN #: 47-0542469

8. The maps, records, or reports resulting from this program shall be made available to the public as promptly as possible. The maps, records, or reports normally will be published by the party of the first part. However, the party of the second part reserves the right to publish the results of this program and, if already published by the party of the first part shall, upon request, be furnished by the party of the first part, at costs, impressions suitable for purposes of reproduction similar to that for which the original copy was prepared. The maps, records, or reports published by either party shall contain a statement of the cooperative relations between the parties.
9. USGS will issue billings utilizing Department of the Interior Bill for Collection (form DI-1040). Billing documents are to be rendered **quarterly**. Payments of bills are due within 60 days after the billing date. If not paid by the due date, interest will be charged at the current Treasury rate for each 30 day period, or portion thereof, that the payment is delayed beyond the due date. (31 USC 3717; Comptroller General File B-212222, August 23, 1983).

U.S. Geological Survey  
United States  
Department of the Interior

Papio-Missouri River Natural Resources  
District

**USGS Point of Contact**

**Customer Point of Contact**

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Omaha, NE 68138  
  
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Email: mpetermann@papionrd.org

**Signatures**

**Signatures**

By \_\_\_\_\_ Date \_\_\_\_\_  
Name: Robert B. Swanson  
Title: NEWS Director

By \_\_\_\_\_ Date \_\_\_\_\_  
Name: \_\_\_\_\_  
Title: \_\_\_\_\_

By \_\_\_\_\_ Date \_\_\_\_\_  
Name: \_\_\_\_\_  
Title: \_\_\_\_\_

By \_\_\_\_\_ Date \_\_\_\_\_  
Name: \_\_\_\_\_  
Title: \_\_\_\_\_

**PROPOSAL**  
**Improved simulation approaches to facilitate integrated management of**  
**surface-water and groundwater resources near Ashland, Nebraska**  
**USGS NEBRASKA WATER SCIENCE CENTER**  
**MIDWEST REGION**

**S.M. Peterson, Lead Hydrologist, P.G.**

**BACKGROUND/INTRODUCTION**

Optimizing water management in eastern Nebraska Natural Resources Districts (NRDs) requires assessment of the effects of water management techniques such as increased on-farm efficiency, groundwater allotments, and municipal conservation programs on groundwater levels and in-stream flow. Simple approaches, such as water-level analysis or analytical modeling, would not capture the complexity of the inter-related surface-water and groundwater resources and would not be able to properly assess such effects.

In 2010, the USGS Nebraska Water Science Center, in cooperation with the Papio-Missouri Natural Resources District (P-MNRD) and the Eastern Nebraska Water Resources Assessment (ENWRA; composed of six NRDs) undertook a preliminary assessment of simulation approaches to facilitate integrated water-resources management in eastern Nebraska (proposal NE-xx FY10, Peterson and Ryter, fig. 1). The approach for that study was to build a fully-coupled simulation capable of simulating complex and accurate landscape hydrology interactions with groundwater and to integrate available airborne geophysical data that had been collected in the area.

The Ashland study area is a 5-mile stretch of the Platte River valley and nearby area. The principal aquifer is Quaternary-age alluvium deposited by the Platte River upon Cretaceous- and Pennsylvanian-age limestone, shale, and sandstone. The valley is flanked by uplands of glacial till with local pocket (isolated sand and gravel deposits) and buried-valley aquifers on the south and east, and the Todd Valley, formed by the ancestral Platte River on the west. The Ashland study area contains the mouth of the Elkhorn River where it joins the Platte River, and is only 20 miles upstream from the mouth of the Platte River where it joins the Missouri River. Estimated base flow of the Platte River near this area ranges from 3,000-4,000 cubic feet per second (ft<sup>3</sup>/s) and that of the Elkhorn ranges from 500-1,000 ft<sup>3</sup>/s (Houston and others, 2013). The study area contains numerous municipal wells for the large surrounding cities of Lincoln and Omaha, as well as smaller nearby communities. The study area contains a suite of extraction wells operated by the U.S. Army Corps of Engineers (USACE), used to remove groundwater contaminated by operations at the former Nebraska Ordnance Plant near Mead, Nebraska.

The preliminary Ashland model study was conducted mainly in Federal Fiscal Year 2011 and resulted in a Farm Process for MODFLOW (version 2, MF-FMP2, Schmid and Hanson, 2009) simulation of the 2001-2009 period. The model used aquifer base surfaces derived from airborne geophysical data (Smith and others, 2008) and featured a manual regression of surveyed resistivity to hydraulic conductivity for the area of the survey, which was limited to the downstream end of the study area. However, the calibration of that model was cursory and project scope did not allow for automated parameter estimation using software such as PEST (Doherty, 2010). Parameter estimation and robust evaluation of parameters leading to greater

transparency have become the expected standard in the groundwater flow modeling community, including Nebraska. Also, the previous study used static 2005 land cover data (University of Nebraska, 2007) rather than representing land use changes through time, and the previous study did not publish documentation of the work.

Additional airborne geophysical data have been collected in the study area since 2010 (fig. 2), for various purposes by ENWRA, ENWRA partners, and the USACE (K. Cameron, ENWRA, written commun., 2015). These data could be used to revise the aquifer surface elevation data used in the previous study. Also, a new approach is available by which to simulate fully-coupled landscape and groundwater hydrology, called MODFLOW-OWHM (Hanson and others, 2014). MODFLOW-OWHM is the fastest and most-comprehensive version of MODFLOW to date, and offers capabilities to include groundwater withdrawal allocations analysis, among other benefits.

## **PROBLEM**

Many groundwater flow models in the northern High Plains aquifer and in Nebraska have been built using simplified representations of recharge (Carney, 2008; Luckey and Cannia, 2006; Peterson, 2007; Stanton and others, 2010) or have been sequentially linked with Soil-Water-Balance models (Stanton and others, 2012; Peterson, 2015, in preparation). However, no local studies have published fully-coupled simulations of landscape hydrology with groundwater flow, and therefore only simulated part of the total hydrologic water balance. These models neglected the runoff component of simulated streamflow and only indirectly handled precipitation, or handled precipitation with Soil-Water-Balance models that do not simulate the water table and hence, improperly handle rejected recharge leading to runoff or sub-irrigation of vegetation, among other important naturally-occurring processes.

The study area includes municipal well fields for Lincoln and Omaha. Recent integrated management plans developed by the Lower Platte North NRD, Lower Platte South NRD, and P-MRNRD have identified sustainability of municipal withdrawals as a critical issue, and highlighted concerns regarding sustainability of municipal water supplies under potential changes in climate or water management. Further, concerns have been raised regarding potential effects of increases in municipal withdrawals on sub-irrigation or other inter-connected hydrology.

## **OBJECTIVES and SCOPE**

The objective of this study is to provide the most advanced and up-to-date comprehensive coupled simulation of landscape and groundwater hydrology possible, to support science-based water-resources management and integrated management planning, for the Ashland study area. This study will provide a selected set of analyses evaluating the effects of changes to the system on inter-related hydrology. This study will provide documentation so that future users of the Ashland model might evaluate other potential changes beyond those documented in the report.

## **RELEVANCE and BENEFITS**

This study will benefit P-MNRD, ENWRA, and other participating NRDs by providing an advanced, comprehensive, coupled simulation of landscape and groundwater hydrology to



support integrated water management. This study will provide regional water managers with information regarding the effects of various management activities on inter-connected hydrology and will provide a tool capable of evaluating the effects of potential climate changes. Information regarding the benefits of using a comprehensive hydrologic simulation also will be provided.

This study correlates with the USGS Water Science Strategy by providing society the information it needs regarding the amount of water in all components of the water cycle at high temporal and spatial resolution; by advancing the understanding of processes that determine water availability; by forecasting changes in the quantity of water resources in response to changing climate, population, land use, and management; and by providing hydrologic analyses and decision-support tools to support water-resource decisions.

This study is consistent with the USGS Cooperative Water Program priority area of Water Availability and Use by providing an improved flow-system definition and simulation to support the management of aquifers and streams. This study also will provide an improved tool for simulating interactions between surface-water and groundwater and for evaluating the consequences of climate variability and change on available water supplies for both agricultural irrigation as well as municipal drinking water.

This study meets goals of the USGS Nebraska Water Science Center Science Plan by providing scientific information regarding water availability and distribution, expanding the knowledge and understanding of water resources in the state, advancing the technology used in studies in Nebraska, and by further developing fully-coupled groundwater/surface-water modeling within Nebraska.

## **APPROACH**

From approximately June 2015 to October 2017, the preliminary Ashland model input data and approaches to calibration will be updated. The updated calibrated simulation will be used for analyses of the effects of selected water-management activities or climate changes on forecasted hydrology and the study will be documented in a report.

Specific tasks include:

1. Extend the simulation period to 2001-2014 (depending upon data availability).
2. Update land-use data to represent changes from 2001 to 2014.
  - a. The preliminary Ashland model used only static land-use data from 2005. Data will be expanded to dynamic land-use representing changes from 2001 to 2014, using data for 2001-2008 published in Houston and others (2013), along with information provided by P-MRNRD.
  - b. Available irrigation-application method data will be incorporated.
3. Update the geologic framework using newly collected geophysical data.
  - a. Airborne geophysical data collected in 2014 and 2015 reportedly will be published by August 2015. Elevations of geologic contacts published with this data will be used as data points for refining elevation contours of aquifer base surfaces used in the preliminary Ashland model.

4. Calibrate the updated model using both manual and automated parameter estimation through PEST.
  - a. Calibration data will be primarily groundwater levels and streamgage data stored in the USGS National Water Information System.
  - b. Automation of pre- and post-processing for parameter estimation largely accomplished through original programming or adopted from similar programs currently in use (for example, used by Peterson, 2015, in preparation).
5. Analyze using the calibrated model:
  - a. Effects of irrigation efficiency changes using real-world examples, such as conversion from gated pipe to pivot or low-efficiency pivot to high-efficiency pivot.
  - b. Effects of increased municipal withdrawals on sub-irrigated crops or other related hydrology.
  - c. Effects of groundwater withdrawal allocations, if additional funding is secured to support the update from MODFLOW-FMP2 to MODFLOW-OWHM.
6. Compare the updated model to a model that does not feature fully-coupled simulation of landscape and groundwater hydrology, or uses a Soil-Water-Balance model, such as the High Plains Groundwater Availability model (Peterson, 2015, in preparation) or other suitable alternative.
7. Publish a USGS Scientific Investigations Report documenting this work.

Though not part of the current scope, additional benefits could be realized through use of newer software (MODFLOW-OWHM). Applications for grant funding will be submitted to support use of MODFLOW-OWHM.

## **QUALITY ASSURANCE/QUALITY CONTROL**

In accordance with USGS Office of Groundwater Technical Memorandum 2015.02, a model archive will be prepared and the Scientific Investigations Report will serve as model documentation. Peer review and other reviews of the report will be conducted according to USGS Fundamental Science Practices.

## **PRODUCTS**

This work will be documented in an online USGS Scientific Investigations Report, with the working title “Integrated Hydrologic Simulation to provide information for integrated management of surface-water and groundwater resources of the Platte River valley near Ashland, Nebraska.”

## **REFERENCES**

Carney, C.P., 2008, Groundwater flow model of the central model unit of the Nebraska Cooperative Hydrology Study (COHYST) Area: Nebraska Department of Natural Resources Report, 95 p., accessed March 1, 2013, at [http://cohyst.dnr.ne.gov/adobe/dc012CMU\\_GFMR\\_081224.pdf](http://cohyst.dnr.ne.gov/adobe/dc012CMU_GFMR_081224.pdf).

- Doherty, J., 2010, PEST, model independent parameter estimation—User manual (5th ed.): Brisbane, Australia, Watermark Numerical Computing, accessed July 26, 2011, at <http://pesthhomepage.org/>.
- Hanson, R.T., Boyce, S.E., Schmid, Wolfgang, Hughes, J.D., Mehl, S.M., Leake, S.A., Maddock, Thomas, III, and Niswonger, R.G., 2014, One-Water Hydrologic Flow Model (MODFLOW-OWHM): U.S. Geological Survey Techniques and Methods 6–A51, 120 p., <http://dx.doi.org/10.3133/tm6A51>.
- Houston, N.A., Gonzales-Bradford, S.L., Flynn, A.T., Qi, S.L., Peterson, S.M., Stanton, J.S., Ryter, D.W., Sohl, T.L., and Senay, G.B., 2013, Geodatabase compilation of hydrogeologic, remote sensing, and water-budget-component data for the High Plains aquifer, 2011: U.S. Geological Survey Data Series 777, 12 p. Available at <http://pubs.usgs.gov/ds/777/>
- Luckey, R.R., and Cannia, J.C., 2006, Groundwater flow model of the western model unit of the Nebraska Cooperative Hydrology Study (COHYST) Area: Nebraska Department of Natural Resources Report, 63 p., accessed July 6, 2007, at [http://cohyst.dnr.ne.gov/adobe/dc012WMU\\_GFMR\\_060519.pdf](http://cohyst.dnr.ne.gov/adobe/dc012WMU_GFMR_060519.pdf).
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- Stanton, J.S., Ryter, D.W., and Peterson, S.M., 2012, Effects of linking a soil-water-balance model with a groundwater-flow model: *Ground Water*, v. 51, no. 4, p. 613-622.
- Stanton, J.S., Peterson, S.M., and Fienen, M.N., 2010, Simulation of groundwater flow and effects of groundwater irrigation on stream base flow in the Elkhorn and Loup River basins, Nebraska, 1895–2055—Phase two: U.S. Geological Survey Scientific Investigations Report 2010–5149, 78 p. with app. Available at <http://pubs.usgs.gov/sir/2010/5149/>

University of Nebraska, 2007, 2005 Land use mapping: Lincoln, Center for Advanced Land Management Information Technologies (CALMIT), digital data, accessed March 15, 2009 at <http://www.calmit.unl.edu/2005landuse/>.

## TIMELINE

Task or Element	FY 2015		FY 2016				FY 2017			
	Apr-June	July-Sep	Oct-Dec	Jan-Mar	Apr-June	July-Sep	Oct-Dec	Jan-Mar	Apr-June	July-Sep
Assemble information, update model period and land use data	X	X	X							
Update geologic data			X	X						
Manual calibration				X						
Automated parameter estimation (calibration)					X	X				
Analysis using model						X	X	X		
Prepare report		X		X		X		X		
Report review and publication								X	X	X

## PERSONNEL

S.M. Peterson: Lead Hydrologist, Groundwater Modeling Team, USGS NEWSW, groundwater-flow modeling expert

J.P. Traylor: Hydrologist, Groundwater Modeling Team, USGS NEWSW, junior staff

Student Intern: yet to be named, NEWSW

## BUDGET SUMMARY

	FY15	FY16	FY17	Total
ESTIMATED TOTAL PROJECT REQUIREMENTS	\$ 48,200	\$ 163,800	\$ 124,900	\$ 336,900
	FFY15	FFY16	FFY17	total
Total USGS Contribution	\$ 41,500	\$ 41,000	\$ 31,200	\$ 113,700
Total COOP Contribution	\$ 6,700	\$ 122,800	\$ 93,700	\$ 223,200

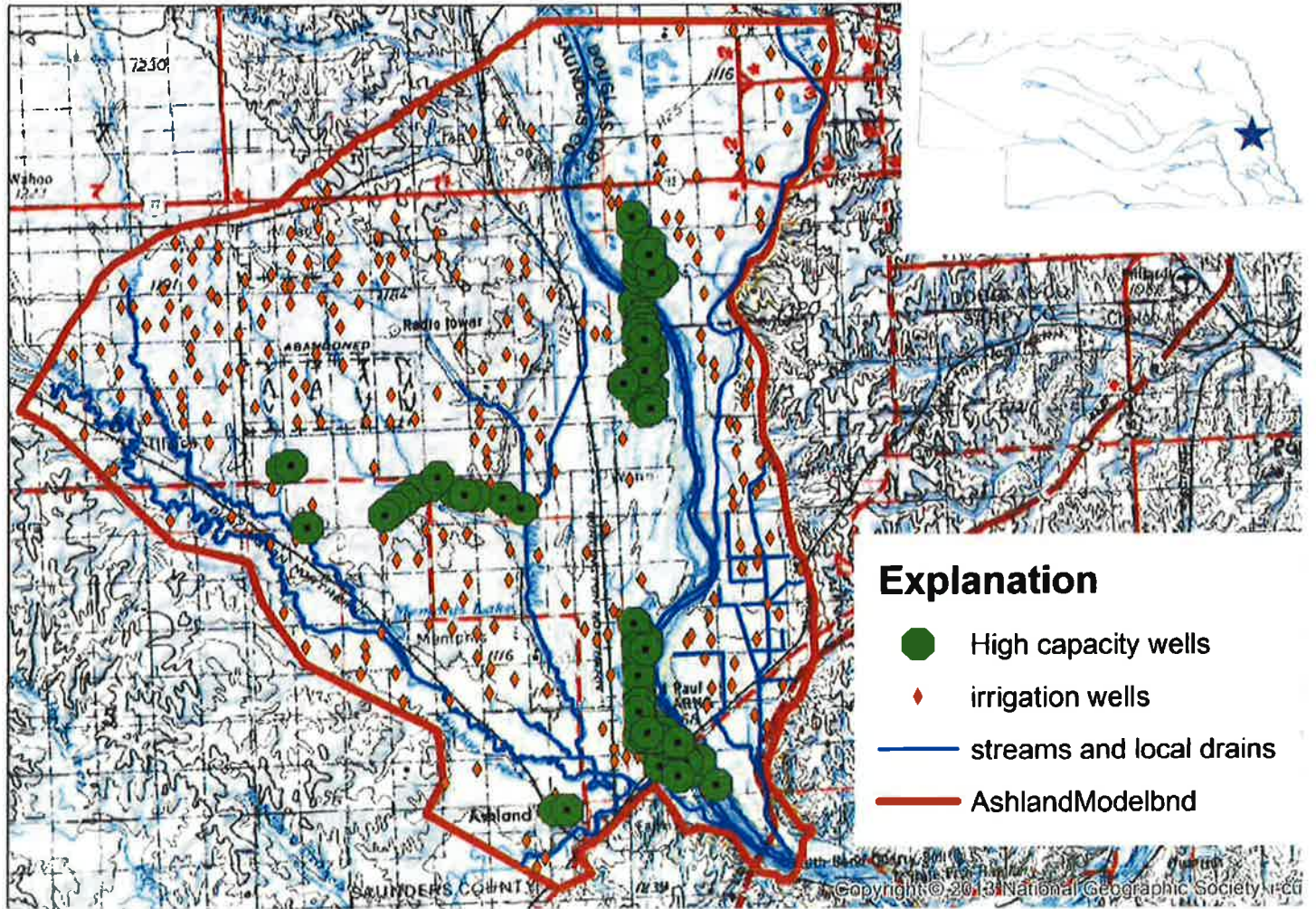


Figure 1. Location of the study area near Ashland, Nebraska.

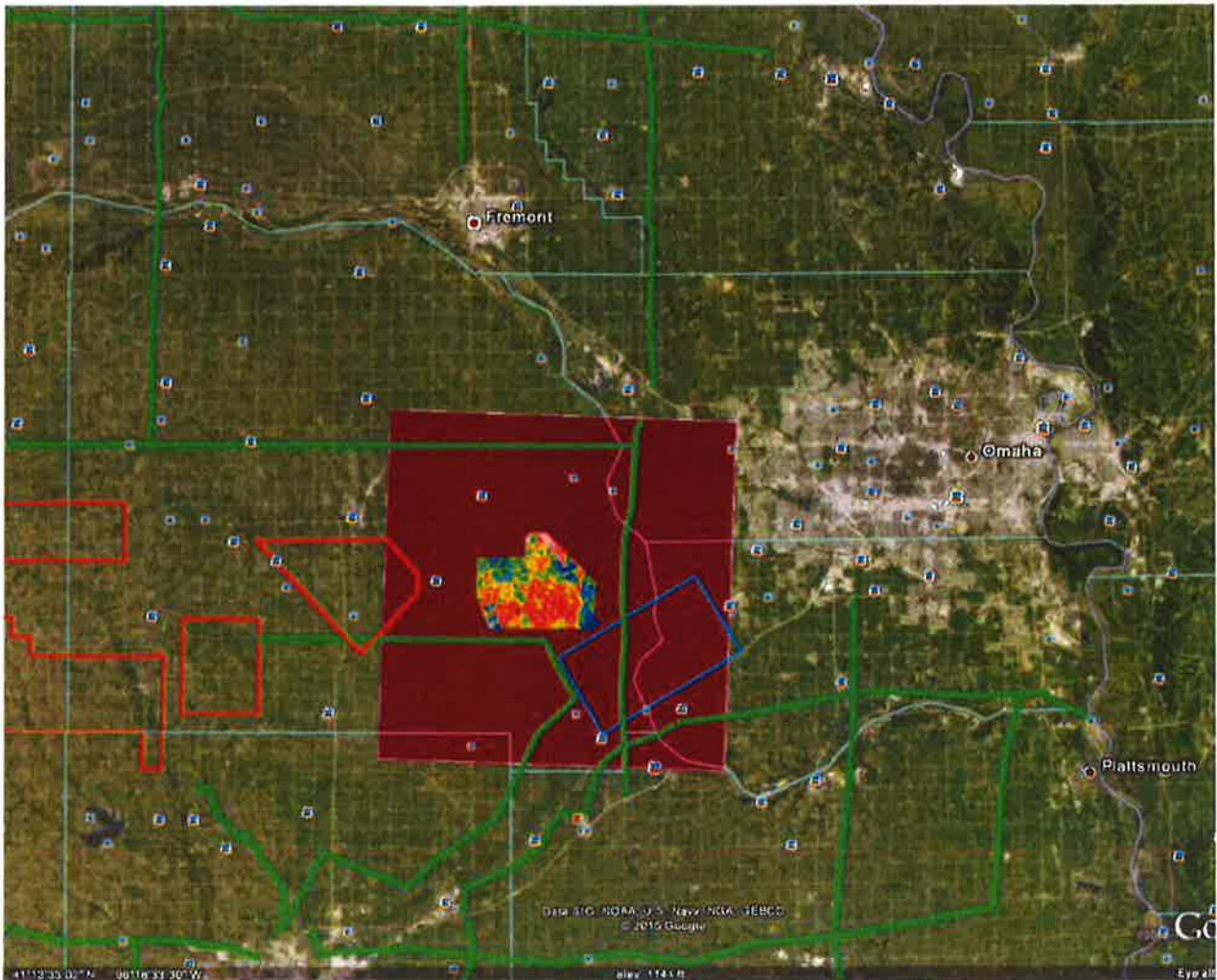


Figure 2. Areas of additional geophysical surveys collected since 2010 (purple box showing preliminary Ashland model grid boundary, light blue rectangle showing previous survey area, new survey areas shown by green lines, red outlines, and multi-color patch in the center of the study area.

**INTERLOCAL COOPERATION ACT AGREEMENT**

**Among**

**LOWER PLATTE SOUTH NATURAL RESOURCES DISTRICT,  
LOWER PLATTE NORTH NATURAL RESOURCES DISTRICT,**

**And**

**PAPIO-MISSOURI RIVER NATURAL RESOURCES DISTRICT**

**For**

**ASHLAND AREA PILOT GROUNDWATER MODEL UPDATE AND REPORT**

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THIS AGREEMENT (“**THIS AGREEMENT**”) is entered into by and among the **LOWER PLATTE SOUTH NATURAL RESOURCES DISTRICT (“LPSNRD”)**, the **LOWER PLATTE NORTH NATURAL RESOURCES DISTRICT (“LPNNRD”)**, and the **PAPIO-MISSOURI RIVER NATURAL RESOURCES DISTRICT (“P-MRNRD”)**. The LPSNRD, the LPNNRD and the P-MRNRD are referred to collectively hereinafter as “**PARTIES**” and sometimes individually as a “**PARTY**”. LPSNRD also enters into this agreement in its separate role as Project Coordinator for the Eastern Nebraska Water Resources Assessment (“**ENWRA**”).

WHEREAS, the **PARTIES** entered into an Interlocal Agreement for the Pilot Model Development on October 20, 2010. The **PARTIES** successfully completed that model, and now desire to enter into this **AGREEMENT** to update the resulting model and publish a final report (the “**PROJECT**”);

WHEREAS, the P-MRNRD intends to enter into a joint funding agreement with the U.S. Geological Survey (“**USGS**”), Nebraska Water Science Center for the completion of the **PROJECT**; and

NOW, THEREFORE, the **PARTIES** do hereby agree as follows:

- 1. BENEFITS.** The **PARTIES** do hereby find, determine and agree that the **PROJECT** will be of general benefit to the **PARTIES**, with only incidental special benefits.
- 2. PROJECT PARTICIPANTS.** The **PROJECT** shall be undertaken by the **PARTIES**, as provided herein, without any separate entity being created, and the duties and responsibilities of the **PARTIES** with respect to the **PROJECT** shall be as defined by **THIS AGREEMENT**. The P-MRNRD shall be the lead organization and manage the **PROJECT**.
- 3. PILOT MODEL TECHNICAL REVIEW COMMITTEE.** Each of the **PARTIES** shall be provided the opportunity to include a member or members of such **PARTY'S** staff to the **TECHNICAL REVIEW COMMITTEE (REVIEW COMMITTEE)**. The **REVIEW COMMITTEE** shall be responsible for providing technical guidance for the development of the **PROJECT**.
- 4. CONTRIBUTIONS BY PARTIES.** As the sole contributions to the P-MRNRD by the other **PARTIES** towards costs of the **PROJECT**, LPSNRD and LPNNRD shall pay to the P-MRNRD the amount of \$11,160.00 each year for three successive years



prior to August 31<sup>st</sup> of each year. The first payments shall be received by the P-MRNRD by August 31, 2015. In addition to its individual contribution, LPSNRD, as Project Coordinator for ENWRA, shall disburse ENWRA funds to the P-MRNRD in the amount of \$11,160.00 each year for three successive years prior to August 31<sup>st</sup> of each year, with the first such disbursement made by August 31, 2015, as ENWRA'S contribution towards costs of the PROJECT.

**5. PROJECT COSTS.** Except as otherwise specifically provided in THIS AGREEMENT, the LPSNRD and LPNNRD shall not be responsible for any PROJECT costs exceeding their respective contributions detailed in Paragraph 4, above, and the costs inherent in their participation in the REVIEW COMMITTEE.

**6. INVOICES.** By July 31, 2015 and annually by July 31<sup>st</sup> of the next two years, the P-MRNRD will prepare and submit an annual invoice to LPSNRD and LPNNRD for their respective contribution detailed in Paragraph 4, above. LPSNRD shall receive a separate invoice for ENWRA's contribution to the costs of the PROJECT. The PARTIES may request from P-MRNRD and P-MRNRD shall provide records of actual expenditures related to the PROJECT.

**7. USGS CO-OP CONTRIBUTION FUNDS.** P-MRNRD intends to enter into an agreement with USGS to complete the PROJECT for approximately \$336,900. P-MRNRD expects to receive approximately \$113,700 in funds from the USGS for the PROJECT, with \$41,500 provided in USGS' fiscal year 2015, \$41,000 provided in USGS' fiscal year 2016, and \$31,200 provided in USGS' fiscal year 2017 ("USGS CONTRIBUTION"). In the event, P-MRNRD does not receive the USGS CONTRIBUTION, whether in the total amount expected or any individual contribution during a fiscal year, P-MRNRD shall have the right, in its sole and exclusive discretion, to terminate this AGREEMENT upon thirty days written notice to the other PARTIES. Upon such termination, the P-MRNRD shall have no further obligations or duties related to this AGREEMENT. In the event this AGREEMENT is terminated pursuant to this section, the LPSNRD, both as a PARTY and separately as Project Coordinator for ENWRA, and the LPNNRD shall each pay to the P-MRNRD fifteen percent (15%) of any costs related to the PROJECT that were incurred by the P-MRNRD prior to termination and that have not been offset by an earlier contribution by the other PARTIES.

**8. AUTHORITY FOR APPROVALS.**

a) Approvals by the LPSNRD, and other LPSNRD discretionary actions contemplated by THIS AGREEMENT, are authorized to be provided by the General Manager of the LPSNRD; and,

b) Approvals by the LPNNRD, and other LPNNRD discretionary actions contemplated by THIS AGREEMENT, are authorized to be provided by the General Manager of the LPNNRD; and,

c) Approvals by the P-MRNRD, and other DISTRICT discretionary actions contemplated by THIS AGREEMENT, are authorized to be provided by the General Manager of the P-MRNRD.

**9. TERM AND DURATION.** THIS AGREEMENT shall be in force and effect from and after its execution by all PARTIES and shall remain in effect until the occurrence of the earliest of the following events: (1) the completion of the PROJECT; (2) the

termination of the AGREEMENT pursuant to Paragraph 7, above; or, (3) the passing of four years from the date of execution of this AGREEMENT.

**10. NON-DISCRIMINATION.** The PARTIES shall not, in the performance of THIS AGREEMENT, discriminate or permit discrimination in violation of federal or state laws or local ordinances because of race, disability, color, sex, age, political or religious opinions, affiliations or national origin.

**11. APPLICABLE LAW.** The PARTIES shall follow all applicable federal and state statutes and regulations in carrying out the faithful performance and terms of THIS AGREEMENT. Each of the PARTIES shall, whenever applicable, require performance under the Fair Labor- Standards Act.

**12. SEVERABILITY.** In the event any portion of THIS AGREEMENT is held invalid or unenforceable for any reason, it is agreed that any such invalidity or unenforceability shall not affect the remainder of THIS AGREEMENT and the remaining provisions shall remain in full force and effect, and any court of competent jurisdiction may so modify any objectionable provision of THIS AGREEMENT so as to render it valid, reasonable, and enforceable.

**13. CAPTIONS.** Captions used in THIS AGREEMENT are for convenience and not for use in the construction of THIS AGREEMENT.

**IN WITNESS WHEREOF**

The LPSNRD has executed THIS AGREEMENT on \_\_\_\_\_, 2015, pursuant to resolution duly adopted by its Board of Directors.

**LOWER PLATTE SOUTH NATURAL RESOURCES DISTRICT**

By \_\_\_\_\_  
**General Manager**

The LPNNRD has executed THIS AGREEMENT on \_\_\_\_\_, 2015, pursuant to resolution duly adopted by its Board of Directors.

**LOWER PLATTE NORTH NATURAL RESOURCES DISTRICT**

By \_\_\_\_\_  
**General Manager**

The P-MRNRD has executed THIS AGREEMENT on \_\_\_\_\_, 2015,  
pursuant to resolution duly adopted by its Board of Directors.

**PAPIO-MISSOURI RIVER NATURAL  
RESOURCES DISTRICT**

By \_\_\_\_\_  
**General Manager**