

Memorandum

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

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

Date: July 1, 2020

Re: Water Sustainability Fund Grant Application for the Lower Platte NRD's 3D AEM Hydrogeologic Framework and Assessment

The District has been a partner of the Eastern Nebraska Water Resources Assessment (ENWRA) project for 13 years. During this time, ENWRA and the PMRNRD have collected almost 1,500 miles of Airborne Electromagnetic (AEM) survey for a total cost of roughly \$1,400,000, see Figure 1. In February, the District received a new WSF grant and agreed to a contract with Aqua Geo Frameworks to collect an additional 1,532 miles of AEM survey in our NRD. Alongside ENWRA, both the Lower Platte North NRD (LPNNRD) and Lower Platte South NRD (LPSNRD) have also collected many miles of AEM survey data in their Districts, see Figure 2.

Before AEM resistivity data can be used directly in a groundwater flow model, the data must be characterized into different geologic layers and assigned variables such as hydraulic conductivity (this tells the model how much water can flow through the layers and how fast). The Lower Elkhorn NRD has performed this type of hydrogeologic assessment for their AEM data and is in the process of preparing a groundwater model for their entire NRD. Nebraska DNR is participating with the LENRD in this modeling process as an update to their Lower Platte-Missouri Tributaries groundwater model (which did not incorporate any AEM data).

NDNR is interested in working with the LPNNRD, LPSNRD and PMRNRD to prepare similar groundwater model updates using their respective AEM data. JEO Engineering in association with LRE Water has prepared a preliminary scope of work and cost estimate (see attached) for all three NRDs to: 1) Combine AEM and available borehole datasets in a 3D geologic model, 2) Define various layers and bedrock in the 3D geologic model, 3) Interpolate datasets from the 3D model to prepare layers and assign variables for use in a future groundwater flow model, 4) provide the 3D model and viewing software as a deliverable. The estimated costs based on this preliminary scope for all three NRDs is as follows:

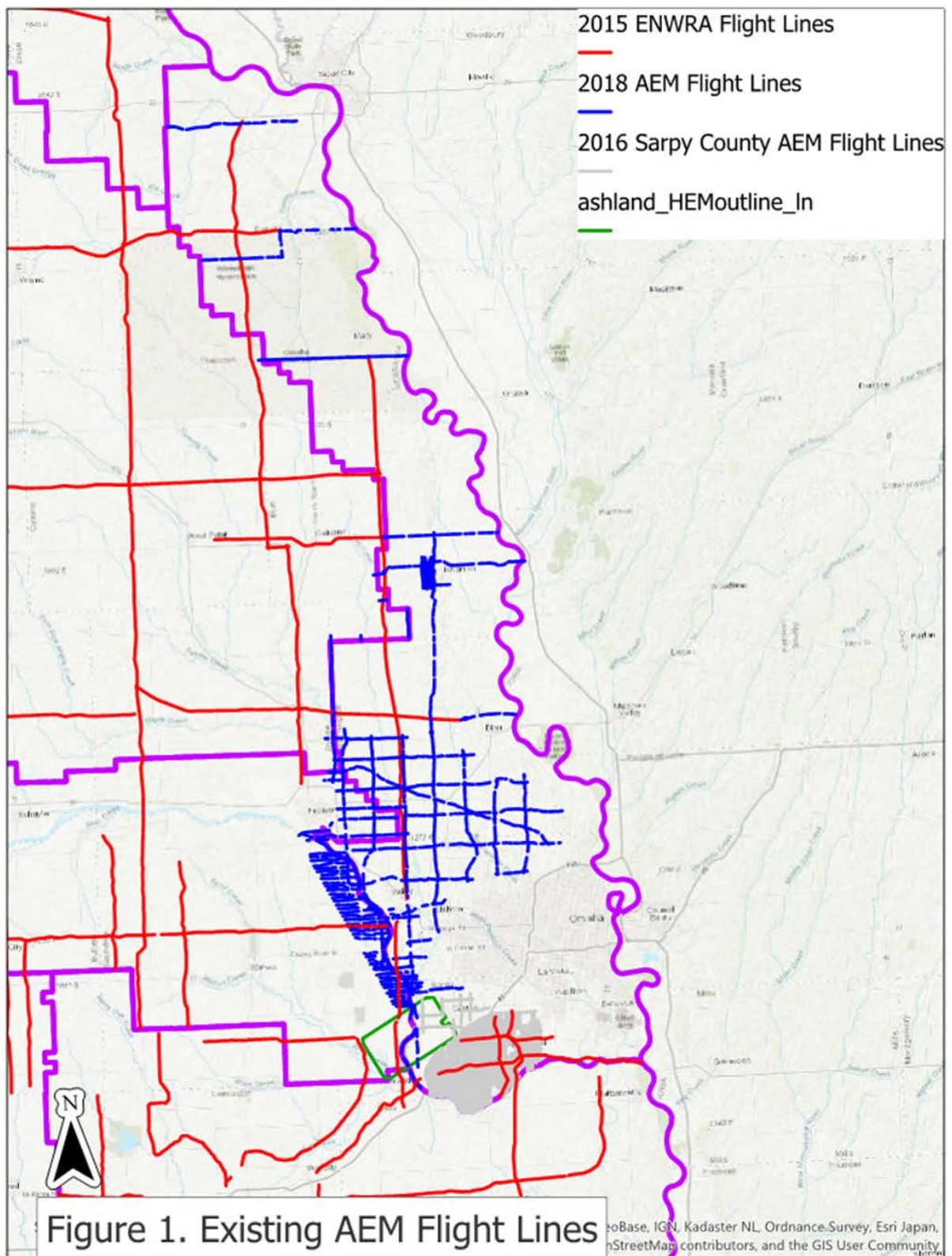
NRD	TOTAL
Papio	\$ 180,000.00
LPS	\$ 177,000.00
LPN	\$ 126,000.00
Total	\$ 483,000.00

Following discussion amongst each NRD's staff, it was recommended that the group work together to prepare a WSF small grant application for less than \$250,000. In the past few grant cycles, these small grants have been used to cover study related costs and all applications submitted have been approved. JEO has been retained to prepare the WSF grant application and a memo discussing the draft project cost, deliverables and schedule is attached. NDNR has also agreed to support the grant application and provide limited funding (see attached). The PMRNRD would serve as the primary applicant for the grant and handle administrative duties as part of a future interlocal agreement.

The projected cost-share for the grant application is:







NRD	Grand Total	NDNR Cash	WSF Balance	WSF	NRD
Papio	\$ 180,000.00	\$ 13,000.00	\$ 167,000.00	\$ 93,000.00	\$ 74,000.00
LPS	\$ 177,000.00	\$ 13,000.00	\$ 164,000.00	\$ 92,000.00	\$ 72,000.00
LPN	\$ 126,000.00	\$ 13,000.00	\$ 113,000.00	\$ 64,000.00	\$ 49,000.00
Total	\$ 483,000.00	\$ 39,000.00	\$ 444,000.00	\$ 249,000.00	\$ 195,000.00
	% Share	8%		52%	40%

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 for the Lower Platte NRD's 3D AEM Hydrogeologic Framework and Assessment project, subject to changes deemed necessary by the General Manager and approval as to form by District Legal Counsel.



ENWRA Airborne Survey Map

ENWRA NRDs

-  Lewis & Clark
-  Lower Elkhorn
-  Lower Platte North
-  Lower Platte South
-  Nemaha
-  Papio-Missouri River

ENWRA FLIGHT LEGEND








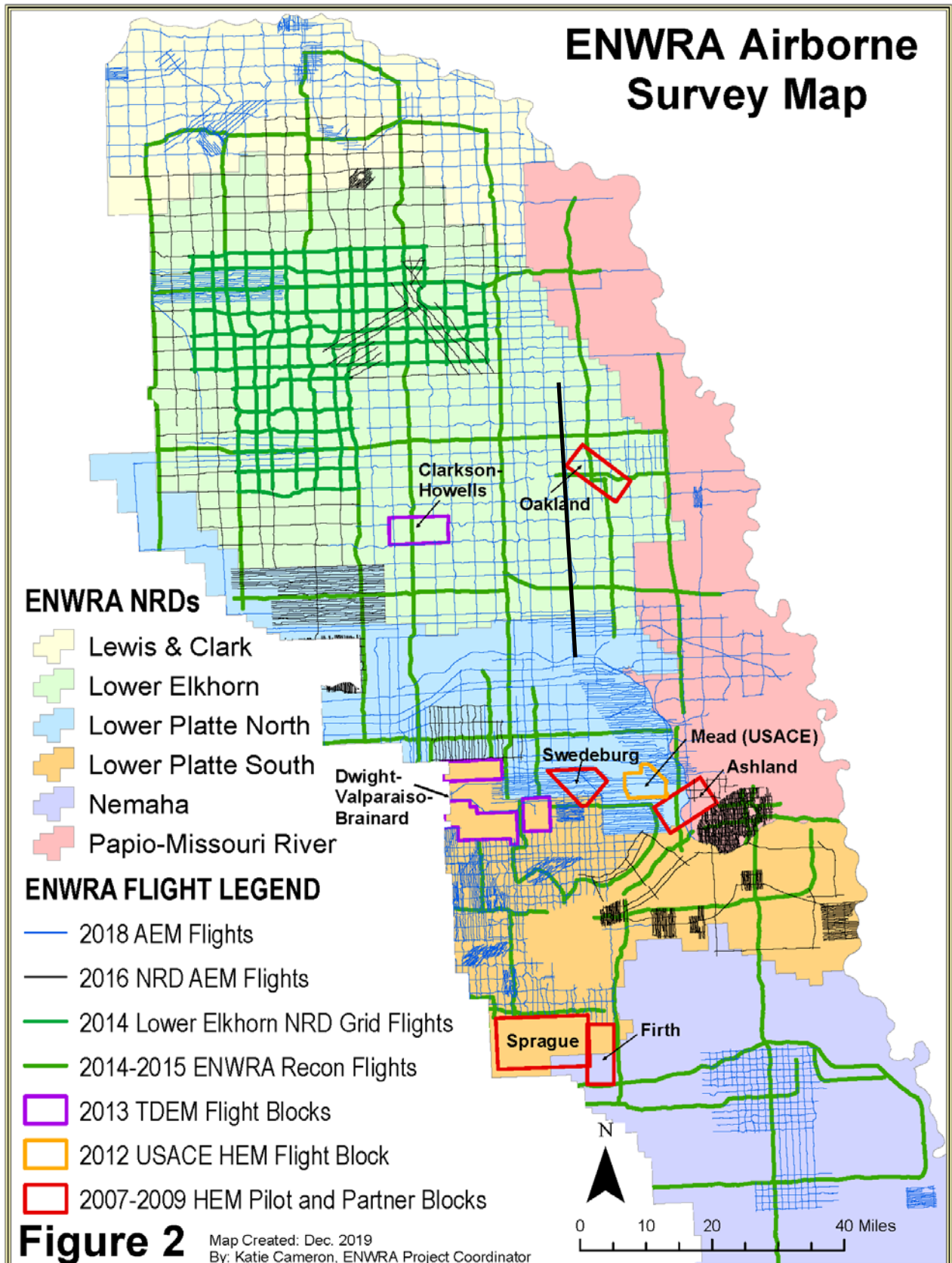
-  2018 AEM Flights
-  2016 NRD AEM Flights
-  2014 Lower Elkhorn NRD Grid Flights
-  2014-2015 ENWRA Recon Flights
-  2013 TDEM Flight Blocks
-  2012 USACE HEM Flight Block
-  2007-2009 HEM Pilot and Partner Blocks

Figure 2

Map Created: Dec. 2019
By: Katie Cameron, ENWRA Project Coordinator





MEMO

To: Paul Woodward, PMRNRD; Dick Ehrman, LPSNRD; Daryl Andersen, LPNNRD
From: Jonathan Mohr, JEO; David Hume, PG, LRE Water
Date: 6/26/2020
Subject: Three-District Hydrogeologic Assessment Project
Water Sustainability Fund (WSF) Application Summary

Project Description

- PMRNRD, LPNNRD, and LPSNRD are forming a partnership to collaborate on a three-district effort for developing the a comprehensive hydrogeologic framework that will utilize existing and future Airborne Electromagnetic (AEM), geologic logs, and other relevant available geologic and hydrogeological reports and data.
- Implementing a similar approach, accepted by NeDNR, and used in 2019/2020 for the Lower Elkhorn NRD groundwater modeling and hydrogeological assessment project, will provide the NRDs in the Lower Platte basin with a consistent and comprehensive assessment deliverable that will include the most recent data, delivered in a user-friendly platform that can be utilized by the NRD's staff, management, and board members; regulators; producers and other high-capacity water users; public water suppliers; and, the general public for future groundwater quality and quantity evaluations, resource management, and educational purposes.
- The **3D AEM Framework**, when completed can be used for, but not limited to:
 - Better understanding the hydrostratigraphy that will assist in characterizing aquifer limits and boundary conditions, groundwater flow systems, and the potential for hydraulic connection between these systems;
 - Evaluating existing and siting and assessing new well permit applications;
 - Completing aquifer vulnerability assessment for protection of groundwater resources and identifying areas for implementing best management practices;
 - Identifying potential areas for groundwater recharge;
 - Evaluating hydrologically connected surface and groundwater; and,
 - Constructing new and refining existing numerical groundwater flow models (i.e., MODFLOW) and other tools that can be used to assist with several the assessment needs above.
- All three NRDs will be provided the following using AEM data:
 - Creation of datasets from the processed AEM data for analyses and interpolation in Leapfrog from all existing and future AEM flight data;
 - Completion of a 3D visualization geologic model for the AEM data using Leapfrog, and provide the NRD with the data files for use in Leapfrog's free downloadable Viewer that



- allows the user to use the 3D model; and,
- Prepare data sets for input and initial discretization and layers for a future groundwater flow model.
- PMR and LPS NRDs will also receive a **Detailed Hydrogeologic Assessment**, which will further evaluate the hydrogeology based on well logs and test hole data, and will include:
 - Completion of a detailed hydrogeologic assessment mapping the key hydrostratigraphic surfaces, and construction of cross sections through each of the NRDs using the borehole lithology from the test hole and wells geologic logs.
 - Creation of a geodatabase and other mapping files in a GIS platform and electronic and/or hard copy assessment report (i.e., “map book”) deliverable format. The assessment deliverable used in conjunction with the 3D geologic model developed from the AEM data using Leapfrog’s viewer will provide the NRDs with the most up to date robust format to assist the NRDs with water management decisions.

Budget

The total project cost is \$483,000 and the per NRD cost for the AEM framework is based upon the quantity of AEM flight miles, test holes, and well logs needing to be assessed. As mentioned above, PMR and LPS also have included the detailed hydrogeologic assessments, an additional \$65,000, in addition to the AEM Framework, therefore their costs are slightly higher than LPNNRD’s. LPNNRD’s framework cost was also reduced slightly due to ongoing hydrogeologic assessment work with LRE/JEO in a portion of their district that would have been completed with the three-district project.

The NeDNR will be approached about providing \$13,000 per NRD, which for WSF purposes, is taken off the top of the cost. From that point, the NRD’s local share was adjusted to bring the total WSF request to less than \$250,000, enabling it to qualify under the “small projects” category.

NRD	Project Total	NDNR Cash	WSF Balance	WSF	NRD
Papio	\$180,000	\$13,000	\$167,000	\$93,000	\$74,000
LPS	\$177,000	\$13,000	\$164,000	\$92,000	\$72,000
LPN	\$126,000	\$13,000	\$113,000	\$64,000	\$49,000
Total	\$483,000	\$39,000	\$444,000	\$249,000	\$195,000
	% Share	8%		52%	40%

Schedule

The schedule is 12 months, and assuming the WSF is successful, the project would start January 1, 2021, and be completed by December 31, 2021.

LPN-LPS-Papio NRD's Total

Area: 5,069 sq. miles
Approx. Cross Sections: 51
Wells*: 45,346
Test Holes*: 657
AEM Flight Lines: 10,682 miles
Wells/Test Holes of Total: 100%
Flight Lines of Total: 100%

*: The total number of wells and test holes is greater when adding each NRD together, because the individual NRD amounts assume data within a 5-mile buffer. Therefore, there is overlap if the three NRD's are completed as one project.

— Future AEM Flight Line
— Existing AEM Flight Line

Papio NRD

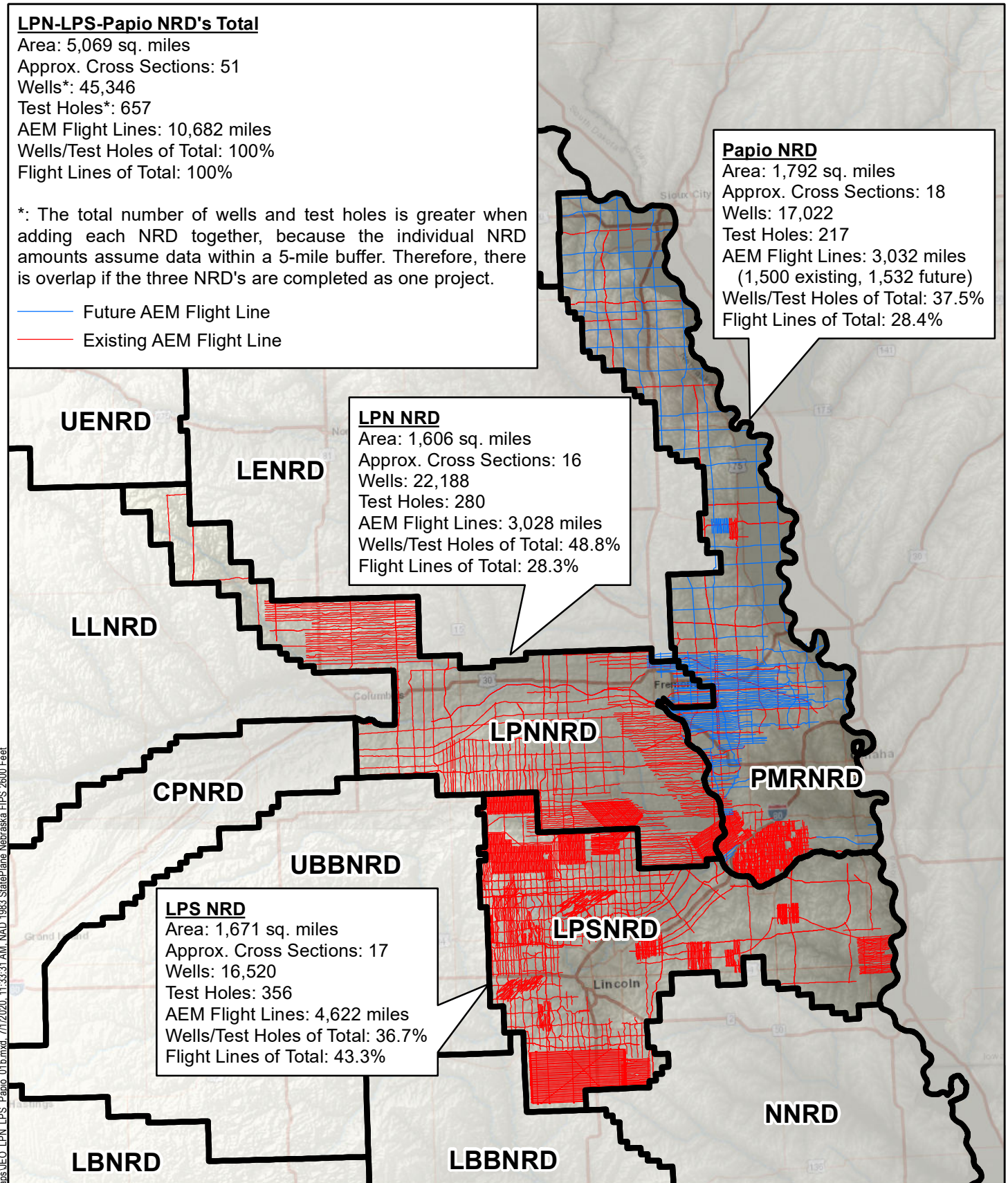
Area: 1,792 sq. miles
Approx. Cross Sections: 18
Wells: 17,022
Test Holes: 217
AEM Flight Lines: 3,032 miles
(1,500 existing, 1,532 future)
Wells/Test Holes of Total: 37.5%
Flight Lines of Total: 28.4%

LPN NRD

Area: 1,606 sq. miles
Approx. Cross Sections: 16
Wells: 22,188
Test Holes: 280
AEM Flight Lines: 3,028 miles
Wells/Test Holes of Total: 48.8%
Flight Lines of Total: 28.3%

LPS NRD

Area: 1,671 sq. miles
Approx. Cross Sections: 17
Wells: 16,520
Test Holes: 356
AEM Flight Lines: 4,622 miles
Wells/Test Holes of Total: 36.7%
Flight Lines of Total: 43.3%



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