

# Nebraska LiDAR 2016

## Proposed Data Collection and Project Information Package



Nebraska Information  
Technology Commission  
GIS Council

5.26.2015

### Overview

LiDAR is an acronym for Light Detection and Ranging, a technology that is used in conjunction with GPS technology, an aerial collection platform, and a processing computer to collect data points that can be used to define the location of objects that reflect near infrared light, including the land surface, structures and vegetation.

Nebraska has identified the collection of topographic (land surface) information as a priority and employs the Nebraska GIS Council's Elevation Working Group as a coordinating group for the effort. The group includes individuals representing federal, state and local entities. Since 2008, the group, its members, and partner agencies have worked to collect LiDAR data over more than 75% of Nebraska's land area. This project, if successfully implemented, will complete the updated baseline collection.

The LiDAR 2016 project has secured nearly \$3 million in seed funding from federal partners. The funding is contingent on support of local entities and contribution of local funds. This document is being provided to facilitate the acquisition of local partners capable of providing funds for the project.

The project is time sensitive. A federal task authorization must be in place in September 2016 that project funds may be encumbered to contract the data collection during the fall of 2016 and spring of 2017. Therefore Nebraska funds must be contributed to the State of Nebraska Office of the CIO in August 2016 under a Joint Funding Agreement, ILCA, or similar contract. To prepare this contract, local funding partners and their respective contributions must be identified by end of June 2016 and finalized by July 2016.

This document contains general information regarding the project, current partners, and partner funding targets in its body, and detailed background information in the attached appendices.

Information requests and/or questions relating to this document or the project can be submitted to the following:

#### **Doug Hallum**

Conservation and Survey Division  
School of Natural Resources  
University of Nebraska - Lincoln  
West Central Research and Extension Center  
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#### **Nathan Watermeier**

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## Project Area

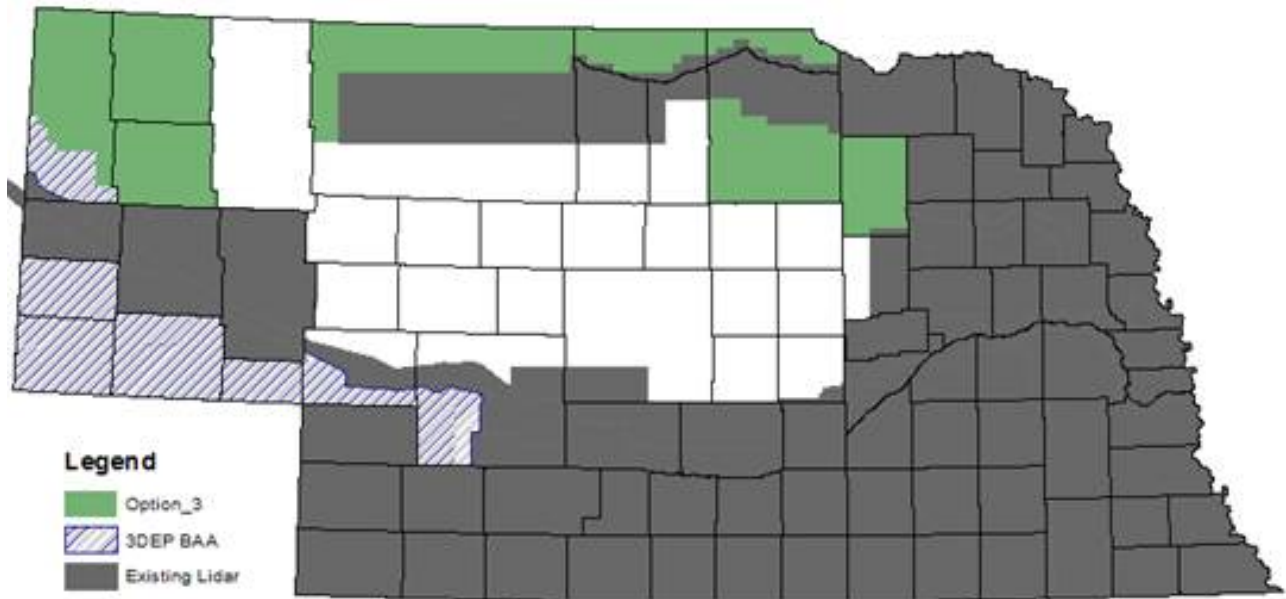
A brief breakdown of project details is included below. All values are estimated and subject to change. The unit cost of collection is dependent on the project size and shape. The estimated unit cost of collection (\$255 per square mile) is anticipated to decrease somewhat during contracting.

**Area = 18,111 square miles** (the white area in the figure below)

**Cost = \$4,618,305** (at \$255 per square mile)

**Benefit/Cost\* = 5:1** for QL2 data, the **project value** is estimated at **\$23,000,000**.

\*Reference: Dewberry, 2011, Final report of the National Enhanced Elevation Assessment (revised 2012): Fairfax, Va., Dewberry, 84 p. plus appendixes, <http://www.dewberry.com/Consultants/GeospatialMapping/FinalReport-NationalEnhancedElevationAssessment>.



### Project Partners and Estimated Funding Targets:

<b>Local Partners</b>	<b>Estimated Target</b>
Lower Loup NRD	\$72,000
Twin Platte NRD	\$24,000
Upper Elkhorn NRD	\$8,000
Upper Loup NRD	\$70,000
Upper Niobrara-White NRD	\$28,000
Other	
<b>State Partners</b>	
<b>State Agencies:</b>	<b>Estimated Target</b>
Natural Resources, Environmental Quality	\$800,000
Game and Parks Department of Roads	
Others	
Nebraska Forest Service	
UNL	
Other	
<b>Federal Partners</b>	
<b>Estimated Target</b>	<b>Estimated Target</b>
NRCS	\$3,000,000
National Forest Service	\$100,000
USGS	\$500,000

Other	
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## Appendix A

### Background Narrative – Project Partners

Directives of the NITC GIS Council to the Elevation Working Group encourage the engagement of partners for acquisition funding and application of collected data. Below are general notes relating to partners engaged in the Nebraska Statewide Elevation Program. Indications of funding support are always dependent on approval by the respective boards of directors and public hearing processes, so do not represent guarantees of funding.

#### **LOCAL PARTNERS:**

Lower Loup NRD (Funding goal \$72,000) – The manager discussed the project in committee, who will recommend contributing to the project at the funding goal; contingent on other partners meeting their respective goals. Their staff are familiar with LiDAR and routinely advocate its collection.

Twin Platte NRD (Funding goal \$24,000) – The funds have been committed for LiDAR collection. The NRD board members and staff are familiar with data collected in other parts of their district and have supported and funded its collection in areas previously collected.

Upper Elkhorn NRD (Funding goal \$8,000) – The manager and the board of directors are supportive of the project, and they plan to allocate funds in their 2017 budget.

Upper Loup NRD (Funding goal \$70,000) – The manager is supportive, and the board is supportive in concept but unable to contribute significant funds. This is a small tax base district. The board has indicated that they can contribute \$3000. We are working with additional partners to secure additional local funds from this region.

Upper Niobrara-White NRD (Funding goal \$28,000) – The manager is very supportive; this contribution is likely. The UNWNRD engaged local partners for a separate collection pending in Sioux, Dawes and Box Butte Counties, and engaged the National Forest Service in Chadron who has joined collection efforts as a federal partner.

#### **STATE PARTNERS:**

NDNR – They have provided the bulk of state funds on several previous projects, and have indicated commitment to this project at a determined target level.

NDEQ – They have a specific, watershed based program that they prefer to use for LiDAR. We do not know if funds are available.

NDOR – They have specific engineering needs, so sometimes collect on their own. We do not know if funds are available.

NE Forest Service – They have interest in specific applications of LiDAR data that are not entirely consistent with the proposed specification. Funds may be available, the level of contribution is uncertain.

NGPC – They have collected LiDAR for local scale projects independently and are supportive of this project. Funds may be available, the level of contribution is uncertain.

OCIO – Coordinates state efforts and administers the interlocal/funding pool agreements, and makes the contract between the state and federal entities. They collect a fee for contract administration.

UNL – UNL contributions include Doug Hallum's time to the Elevation Working Group and Les Howard's time to the NITC GIS Council. We do not know if funds are available.

#### **FEDERAL PARTNERS:**

NFS – Their Chadron office committed year-end funds in 2015 to a pending collection (9,000 square miles), and has generated support in their regional/national offices for this project. Funds may be available, the level of contribution is uncertain.

NRCS – NRCS proposed the LiDAR 2016 project by committing significant funds to the project, contingent on support and funding commitments from Nebraska. They have collected much of the data collected in Nebraska previously.

USGS – They have been involved since 2008, and have been the driving force behind the QL-2 standard, and have previously bought-up projects to meet that standard. They can do the contract with the LiDAR vendors – they collect a fee for the service. They also complete independent data QA/QC for projects where they are a partner (as in-kind contribution). Funds may be available, the level of contribution is uncertain.

## Appendix B

### Data Examples (Nebraska Sandhills), Specifications, Standards and Business Plan

#### Data Examples

Elevation data has previously been developed for the project area, and reviewing some basic information is worthwhile to recognize changes and improvements in the data and data collection methods. Previous topographic data development was conducted by the US Geological Survey by transcribing overlapping aerial images using an analog stereoplotter, creating either 10 or 20 foot contour intervals for the area proposed in this project. The proposed data collection digitally measures the distance to each point on the ground from an elevated platform (often an airplane), resulting in a point value measured every couple of feet along the ground. The table below compares a few of the metrics used to assess the robustness of elevation data.

	Existing	Proposed
Collection timeframe	1946-1985	2016-2017
Horizontal accuracy	identifiable point (road intersection)	2 feet
Vertical accuracy	5-10 feet	0.5 feet
Best resolution	10m DEM (interpolated from contours)	1m DEM (point data)
Contour interval	10-20 feet	1 foot

The next page shows visual examples on how LiDAR is incorporated into mapping and applications.

#### Standards and Business Plan

Since the form of elevation data and methods of data collection have changed significantly, extensive work has been conducted to analyze the respective data for the purpose of formulating state and federal standards and guidelines. The documents listed below (available via hyperlinks) were developed to help ensure quality data for a broad range of possible applications, as well as helping to ensure consistency between data collected at different times.

##### Standards and Guidelines for Nebraska:

Elevation Acquisition using LiDAR Standards ([NITC 3-203](#))

Geospatial Metadata Standard ([NITC 3-201](#))

##### Standards and Guidelines for Federal Agencies:

USGS [LiDAR Specifications V1.2](#)

##### Nebraska Statewide Elevation Program Business Plan:

[http://nitc.ne.gov/gis\\_council/workgroups/elevation/documents/NITCGISCouncilElevationBusinessPlan2015.pdf](http://nitc.ne.gov/gis_council/workgroups/elevation/documents/NITCGISCouncilElevationBusinessPlan2015.pdf)

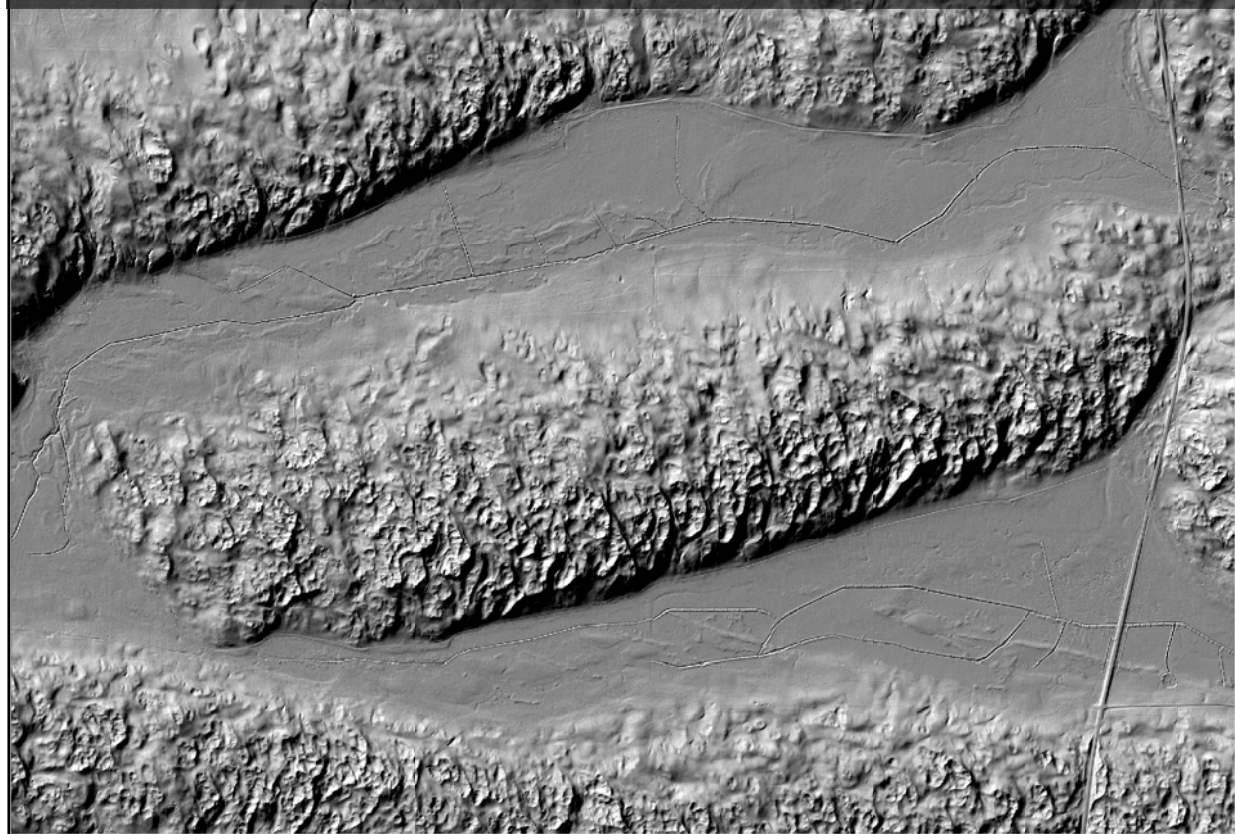
Elevation data are used for many applications, and improving the accuracy and resolution of the data will significantly improve decisions derived from the data. A number of publications are available describing anticipated costs and benefits associated with updated elevation data, including USGS's [3D Elevation Program Summary for Nebraska](#) and [National Enhanced Elevation Assessment at a Glance](#), Dewberry's comprehensive [National Enhanced Elevation Assessment](#). Images illustrating LiDAR elevation data and simple derivatives are included on the following pages. Modern imagery is shown as a baseline illustrating vegetative cover and civil infrastructure.



Basemap showing 2014 NAIP image of sand dunes and interdunal valleys.

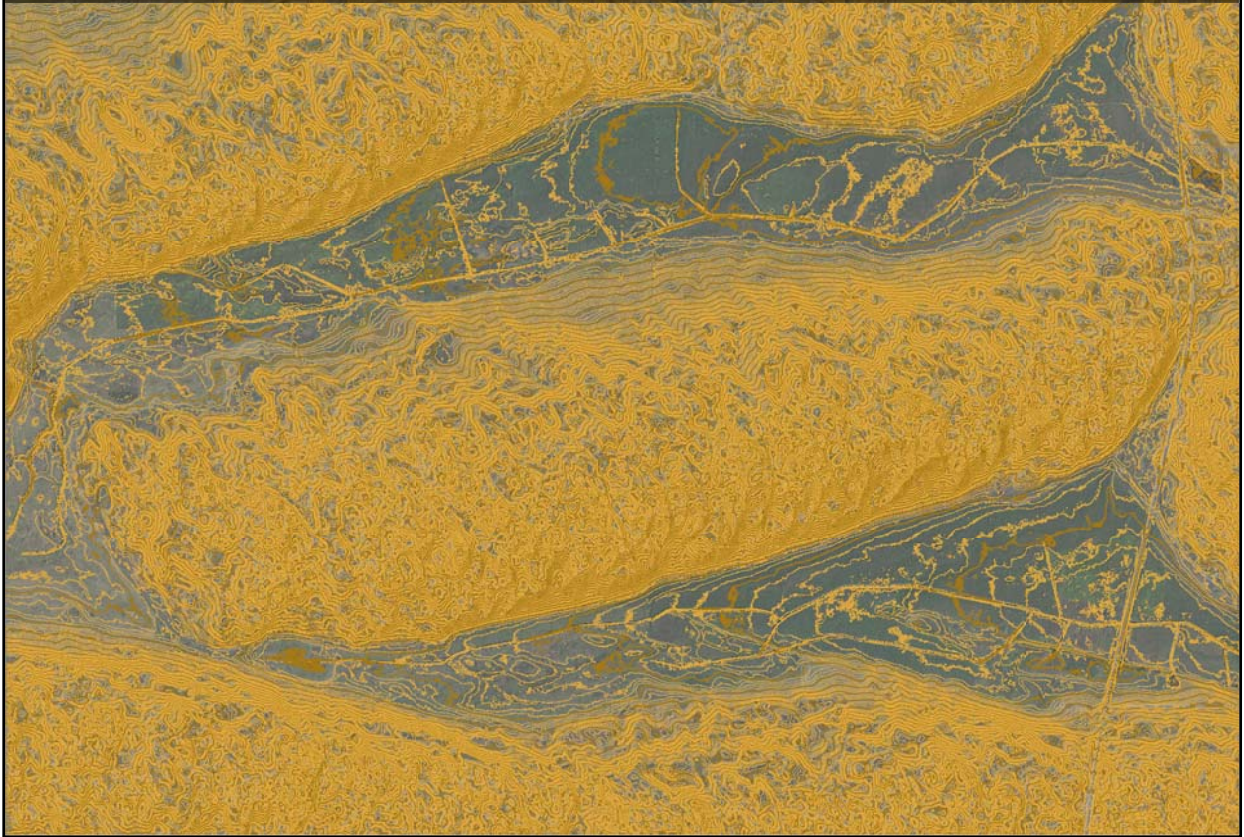


Hillshade of LiDAR derived digital elevation model.

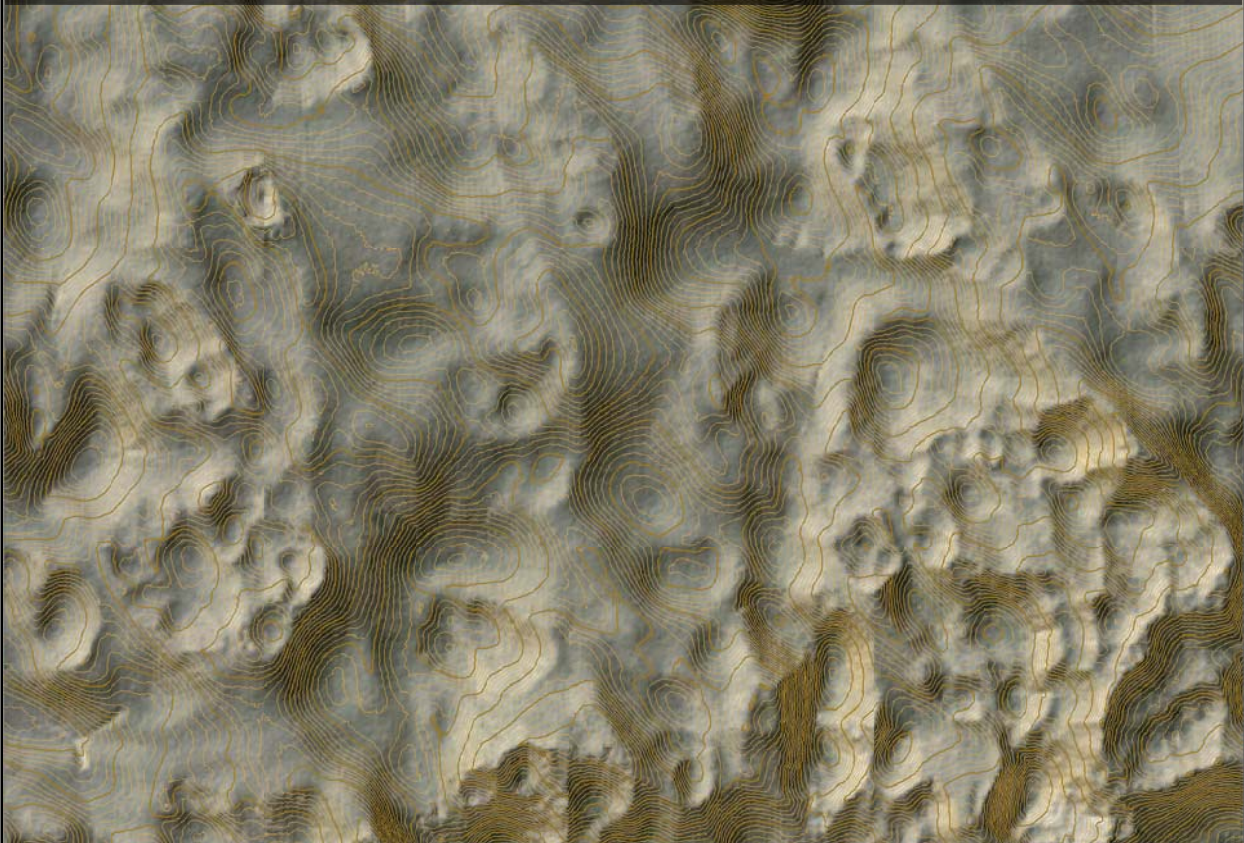




2 foot elevation contours over digital elevation model with imagery



Close up of 2 foot contours on dune surface showing many small internally drained depressions.





Basemap showing 2014 NAIP image of stream confluence in sand dunes.

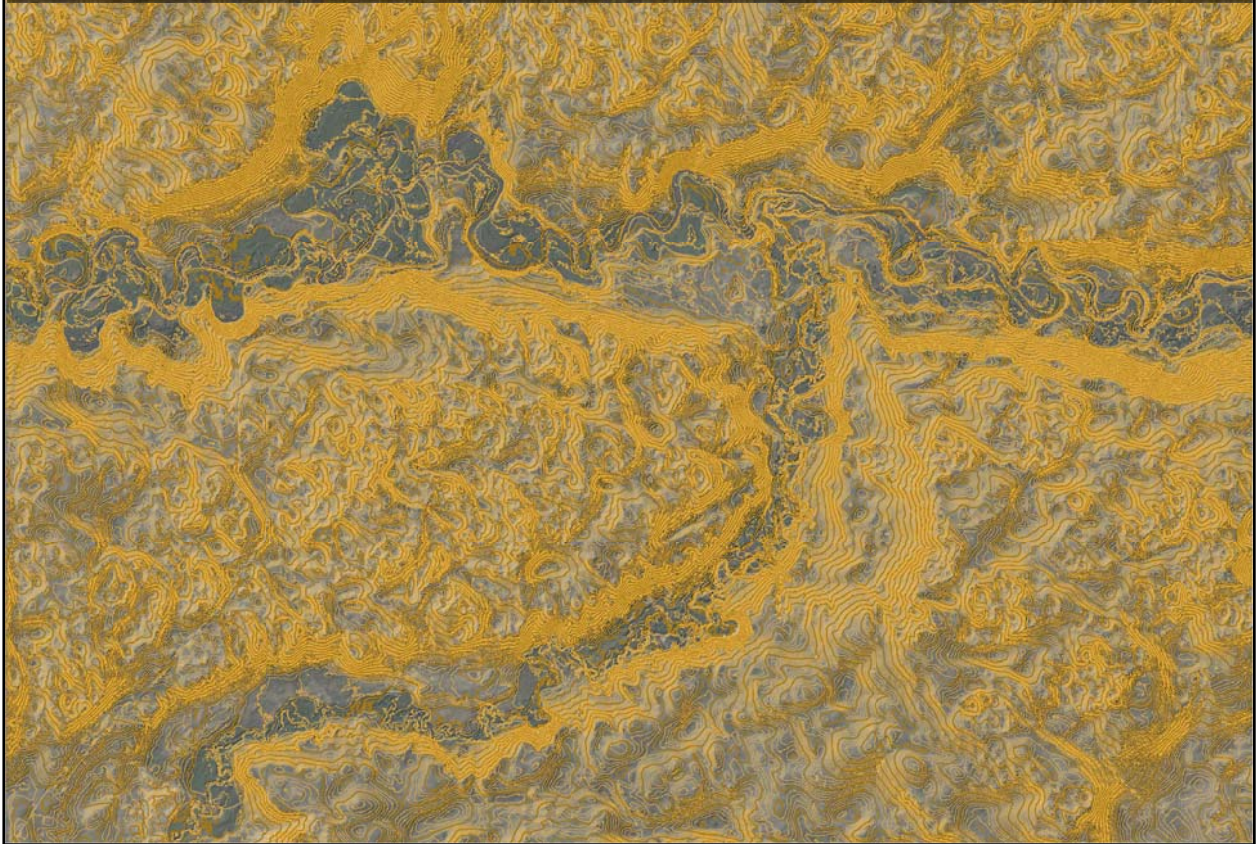


2014 NAIP image draped on hillshade of LiDAR derived digital elevation model.





2 foot elevation contours over digital elevation model with imagery.



**Appendix C**  
**Nebraska GIS Council and**  
**Elevation Working Group Members**

**NITC GIS Council:**

Member (M) / Designee (D)

Timothy Cielocha - Chair (M)  
 Jon Kraai - Vice-Chair (D)  
 Bill Wehling (D)  
 Josh Lear (D)  
 Mike Preston (M)  
 Chad Boshart (D)  
 Karis Bowen (D)  
 Lash Chaffin (M)  
 Erin Northwall (D)  
 John Beran (D)  
 Nancy Cyr (D)  
 Eric Herbert (M)  
 Les Howard (D), Milda Vaitkus (D)  
 Cullen Robbins (D)  
 James Langtry (M)  
 James W. Ohmberger (D)  
 Jeff McReynolds (M)  
 Chuck Wingert (M)  
 Kim Wessels (M)  
 Todd Wiltgen (M)  
 Sudhir Ponnappan (D)  
 Ruth Sorenson (D)  
 Gary Morrison (D)  
 Michael Schonlau (M)  
 Pat Larson (M)  
 Todd Whitfield (M)  
 Nathan Watermeier

Representing

Public Power Districts  
 Nebraska State Patrol  
 Department of Roads  
 Department of Natural Resources  
 Nebraska Geospatial Professional Association  
 Nebraska Emergency Management Agency  
 Department of Health and Human Services  
 League of Nebraska Municipalities  
 Governor's Policy Research Office  
 State Surveyor  
 Clerk of the Legislature  
 Omaha Metro Area  
 Conservation and Survey Division  
 Nebraska Public Service Commission  
 USGS Geospatial Liaison for NE  
 Office of the CIO  
 Lincoln Metro Area  
 Nebraska Association of Resources Districts  
 Nebraska Association of County Officials  
 Nebraska Association of County Officials  
 Game and Parks Commission  
 Department of Revenue  
 Department of Environmental Quality  
 Member At Large  
 Member At Large  
 Member At Large  
 NITC GIS Council Coordinator

**Elevation Working Group:**

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 Doug Hallum  
 Ken Hartwig  
 Les Howard  
 Jim Langtry  
 Josh Lear  
 Eric J. Morrison  
 Amy Zoller

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 Conservation and Survey Division, UNL  
 U.S. Geological Survey  
 Nebraska Department of Natural Resources  
 U.S. Army Corp of Engineers  
 Nebraska Department of Natural Resources