LIDAR and its Applications

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Northeast Community College
Norfolk, NE
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Outline

- What is LIDAR?
- Why do we want it?
- Developing the case
  - LIDAR Advisory Council
  - Things to consider
  - Funding
- Case Studies in LIDAR application
- What can it do for us?

What is LIDAR?

- Light Detection and Ranging
- LIDAR Uses:
  - A laser, a platform and a processor
- LIDAR Produces:
  - Points with XYZ coordinates
- With QA/QC and processing, we can:
  - Build surfaces (land, structures, vegetation)

Why do we want LIDAR?

- Flood and storm water management
- Agriculture
- Emergency management
- Water resources
- Soil and water conservation
- Science and education
- Natural resource management
- Construction
- Transportation
- Infrastructure
- many others

Developing the Case – Advisory Council

- Established November 1, 2007 by the GIS Steering Committee
- Lead Agency: NDNR
- Purposes:
  - Bring together staff from agencies
  - Assess existing elevation data
  - Cost/Benefit
  - Build a business case for acquisition
  - Recommend specifications and deliverables

Developing the Case – Advisory Council

- Nebraska Office of the CIO
- Nebraska Department of Natural Resources
- Nebraska Department of Roads
- Nebraska Department of Aeronautics
- United States Geological Survey
- National Geodetic Survey
- US Department of Agriculture - NRCS
- University of Nebraska – Lincoln
- University of Nebraska – CALMIT
- Douglas County
- Lancaster County
- Sarpy County
- City of Lincoln
- City of Omaha
- City of Scottsbluff
- Central Nebraska Public Power and Irrigation District
- Nebraska Public Power District
- Metropolitan Utilities District
- Olsson Associates - Omaha
- MC Schaff – Scottsbluff
- Lower Platte South Natural Resources District
- Central Platte Natural Resources District
- Papio-Missouri River Natural Resources District
- Platte River Recovery Implementation Program
- Rain Water Basin Joint Venture

Developing the Case – Things to consider

- Different requirements for various end users (Post processing, Vertical/horizontal accuracy, FEMA standard?)
  - Data storage and distribution
  - Hardware requirements
  - Metadata
  - Deliverables
  - Timeline and funding

Developing the Case – Funding

Current estimate for statewide LIDAR at FEMA standards is ~$8 million -or- $0.16 per acre!

- ~$2.5 million already spent by:
  - Rainwater Basin Joint Venture
  - Platte River Recovery Implementation Program
  - Republican River basin

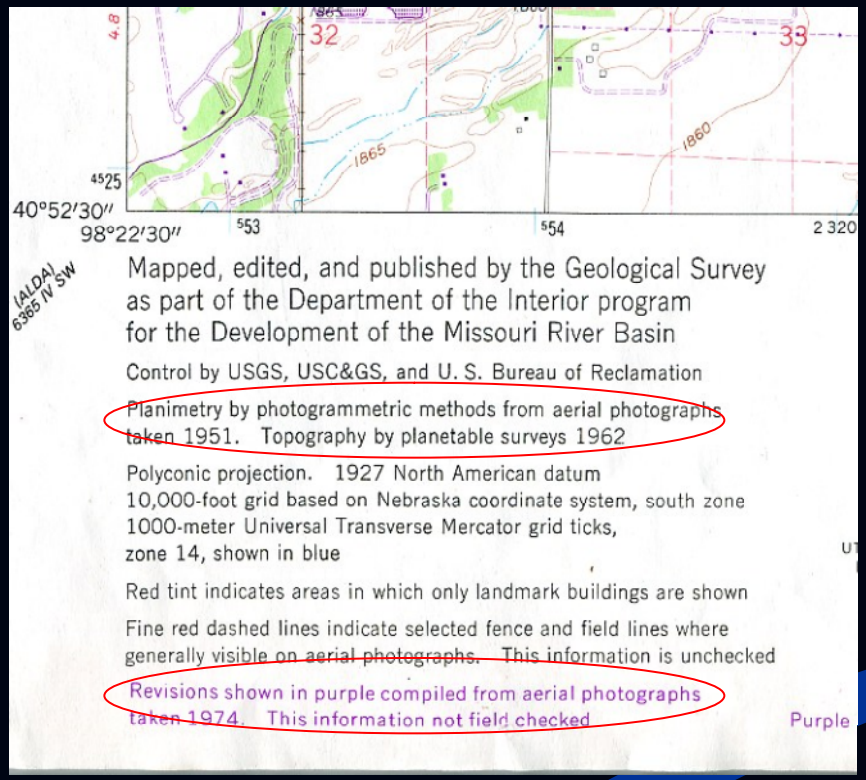
Only $5.5 million left to go!

Case Studies:

- Available data
- Elevation Contours
- Terrace Storage Volume
- Inundation Maps
- Erosion Map
- Floodplain Mapping
- Streambed Configuration
- Streambed Morphology

Case Study – Available Data

Currently available elevation data:



- USGS Quads
- 30m and 10m DEMs
- Select areas of photogrammetric and LIDAR data

Geospatial Coordination
FEMA Region VII

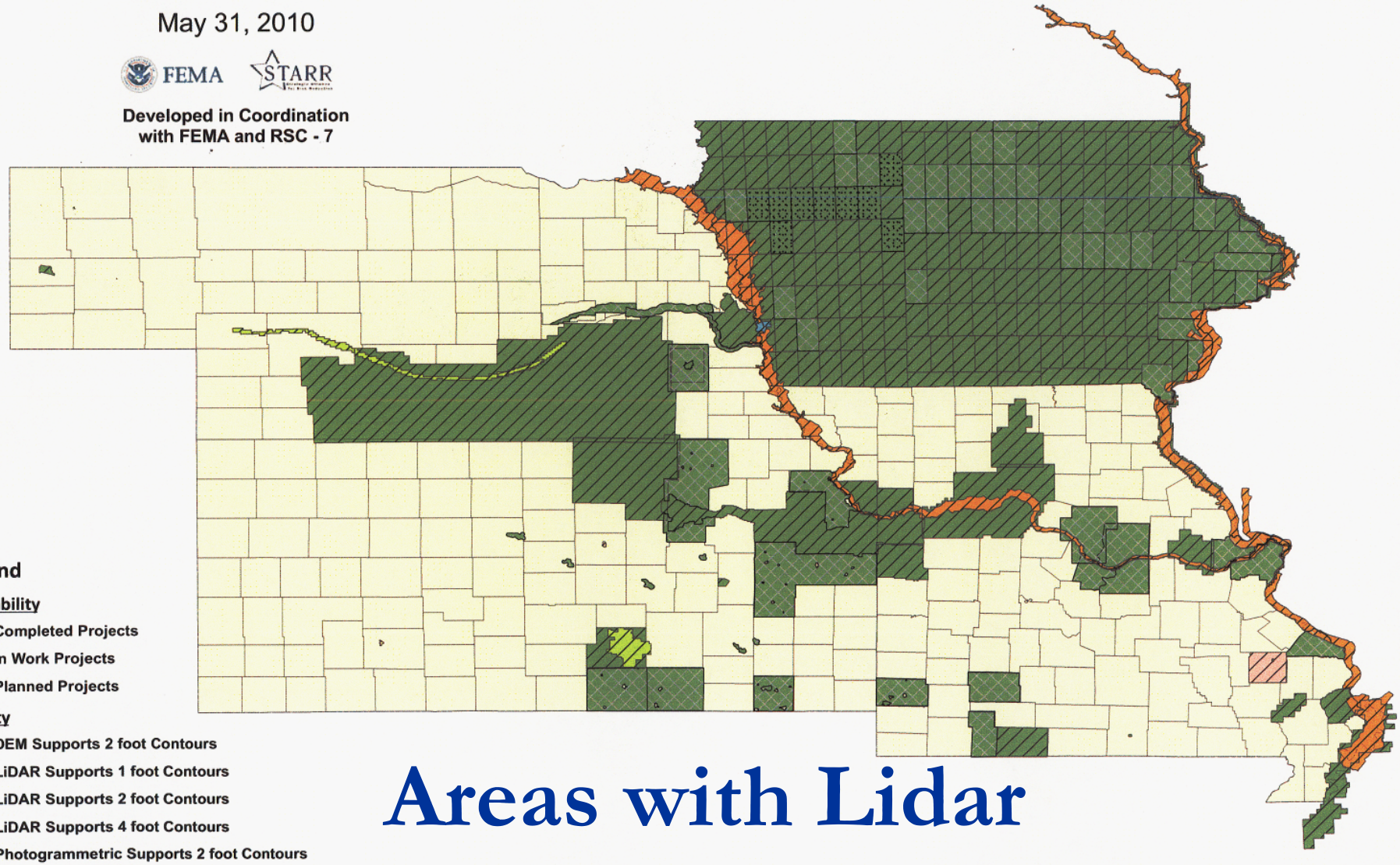
Topographic Inventory Status Map

May 31, 2010

FEMA STARR

Developed in Coordination with FEMA and RSC - 7

Basemap Source: ESRI
NOTE: Map scale is not referenced



Legend

Availability

- Completed Projects
- In Work Projects
- Planned Projects

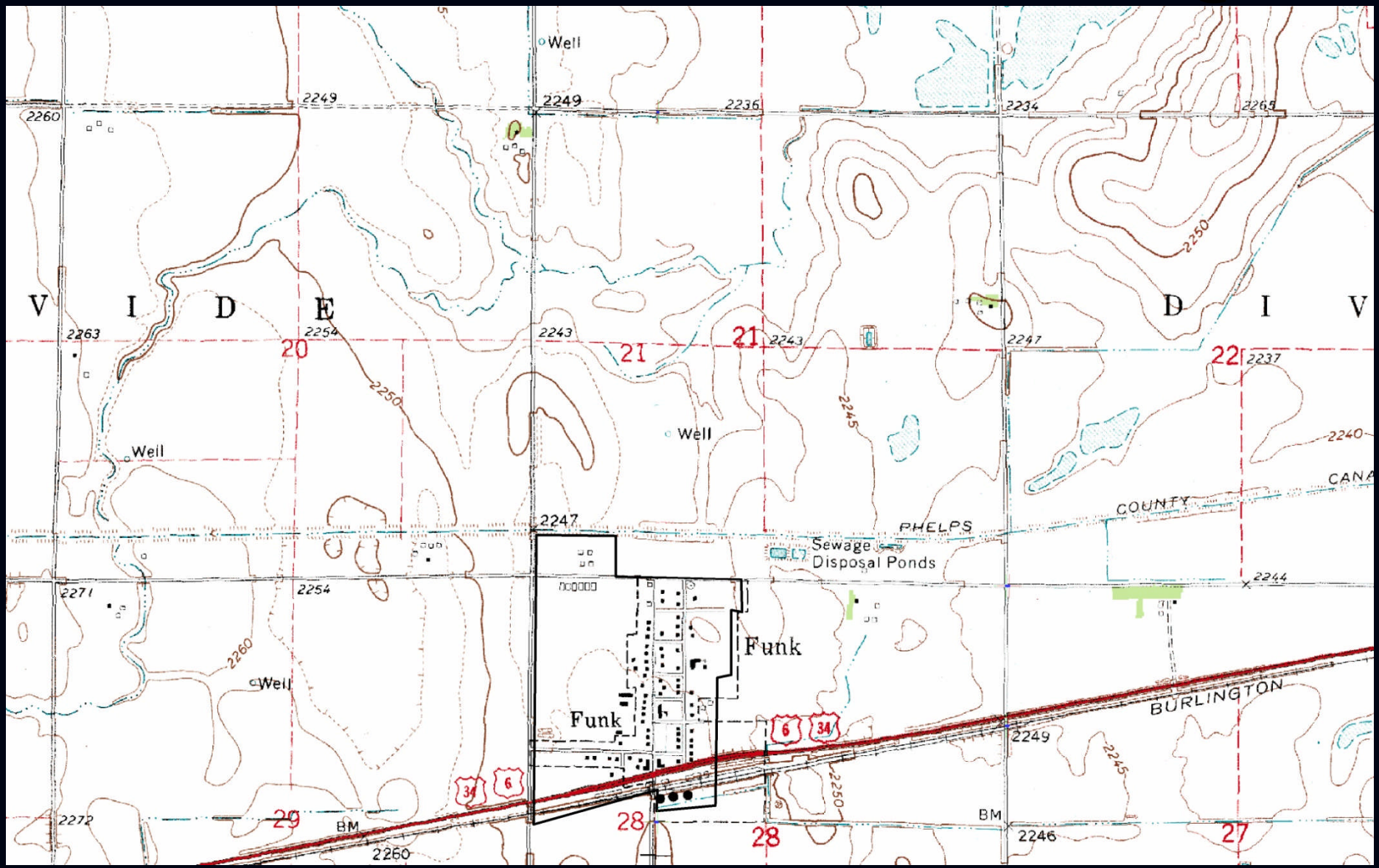
Quality

- DEM Supports 2 foot Contours
- LiDAR Supports 1 foot Contours
- LiDAR Supports 2 foot Contours
- LiDAR Supports 4 foot Contours
- Photogrammetric Supports 2 foot Contours
- Photogrammetric Supports 4 foot Contours

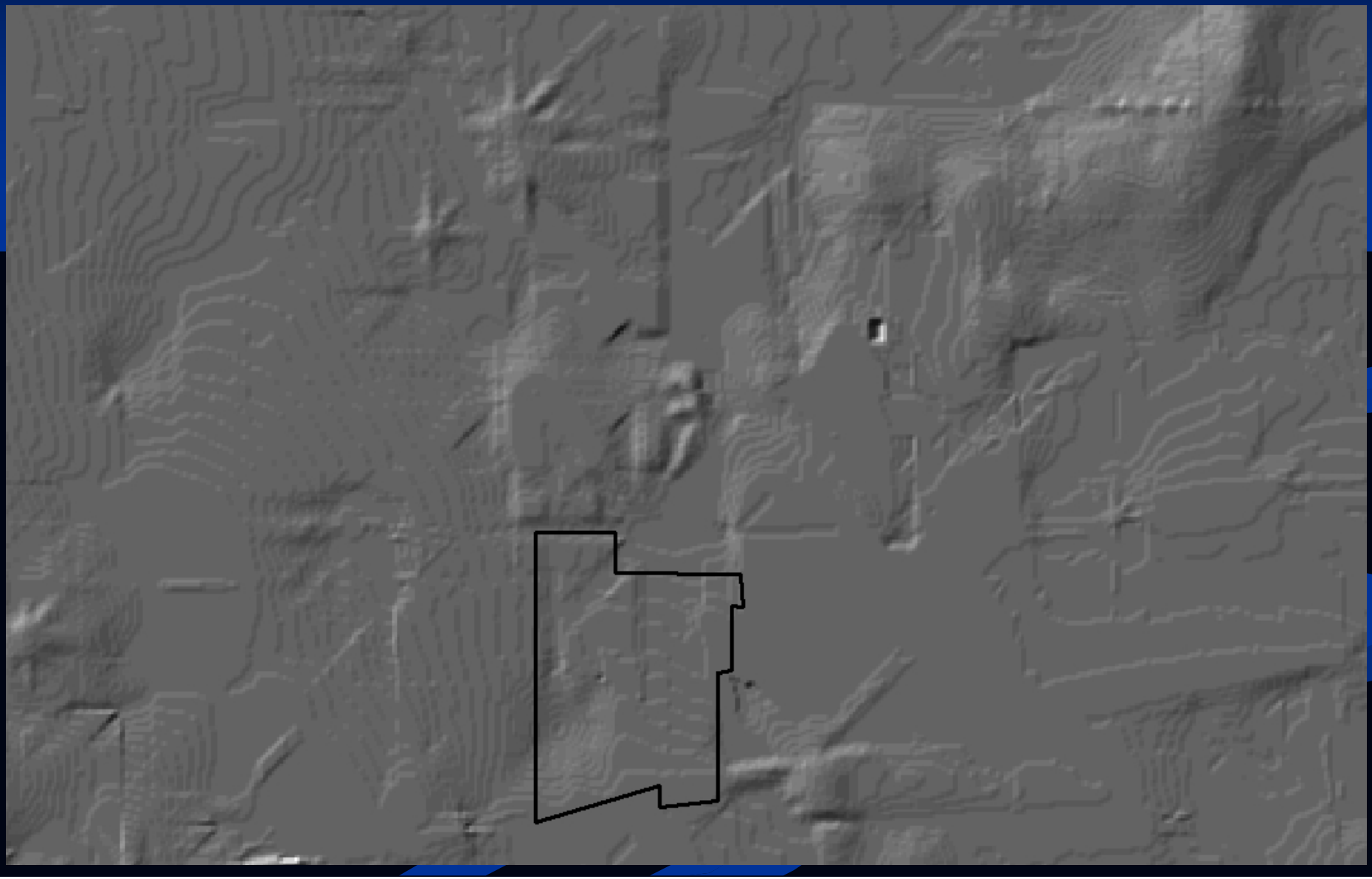
Areas with Lidar

Funk, NE

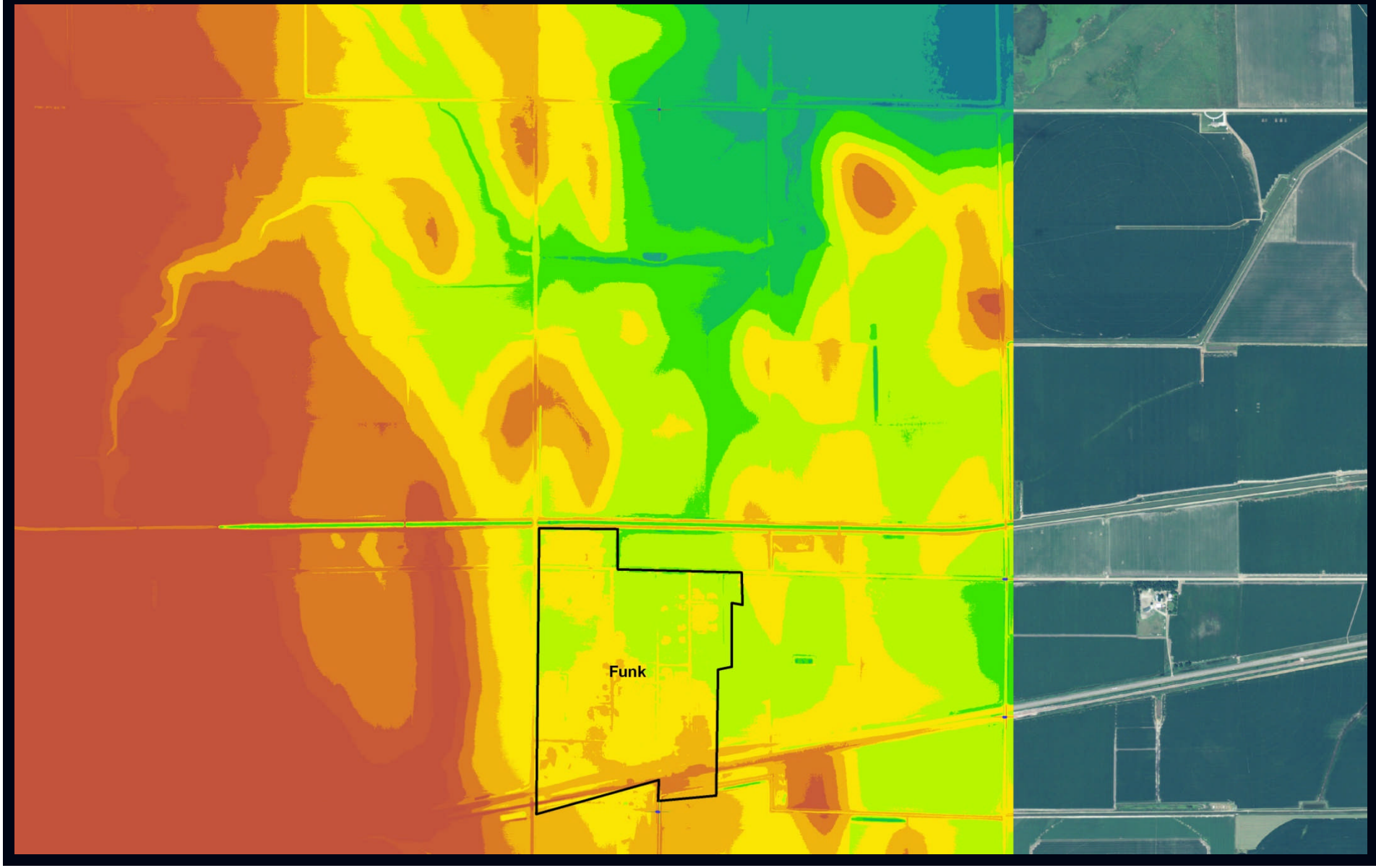
Elevation Contours - DOQ



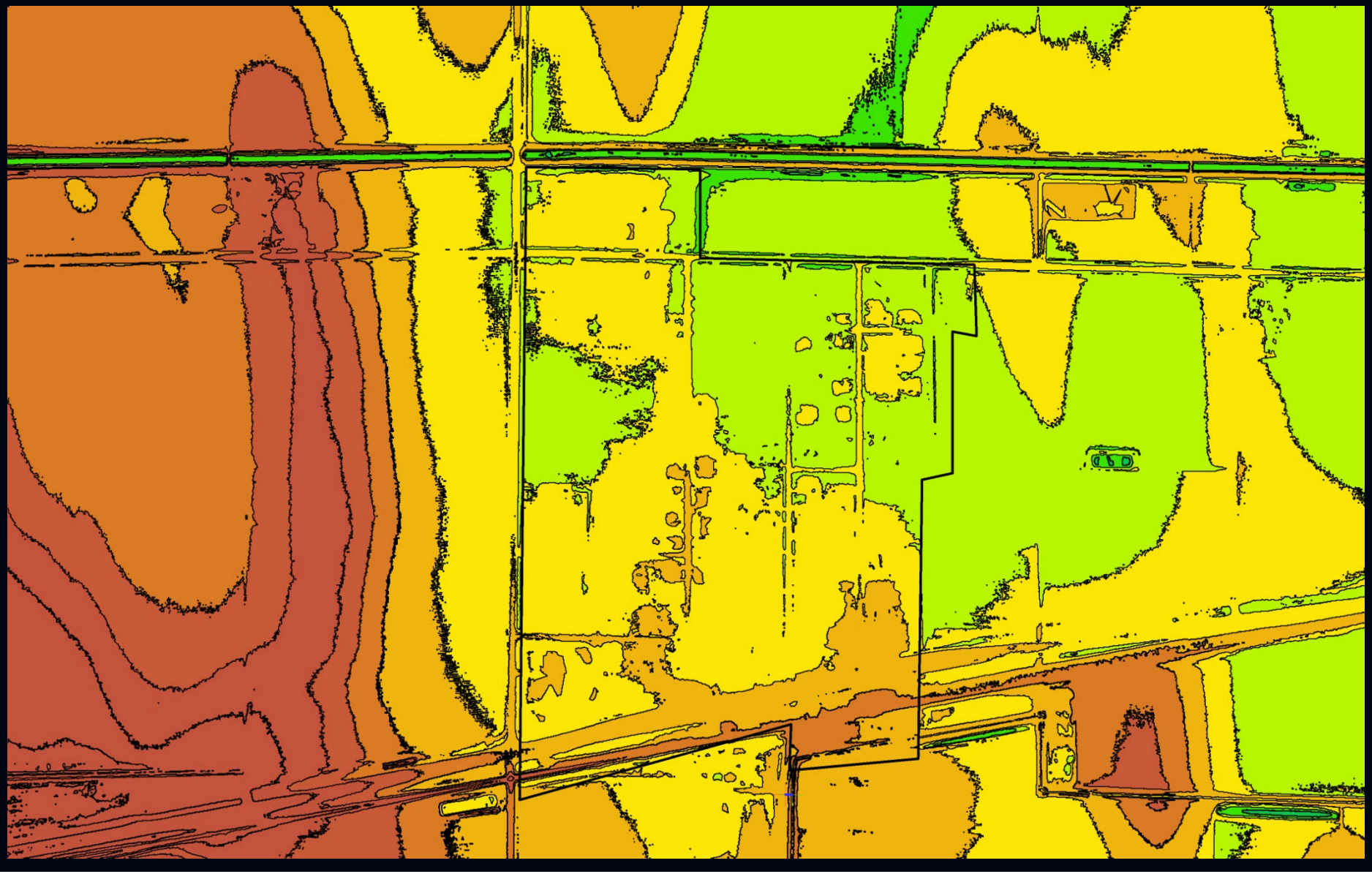
Elevation - DEM



Elevation - LIDAR



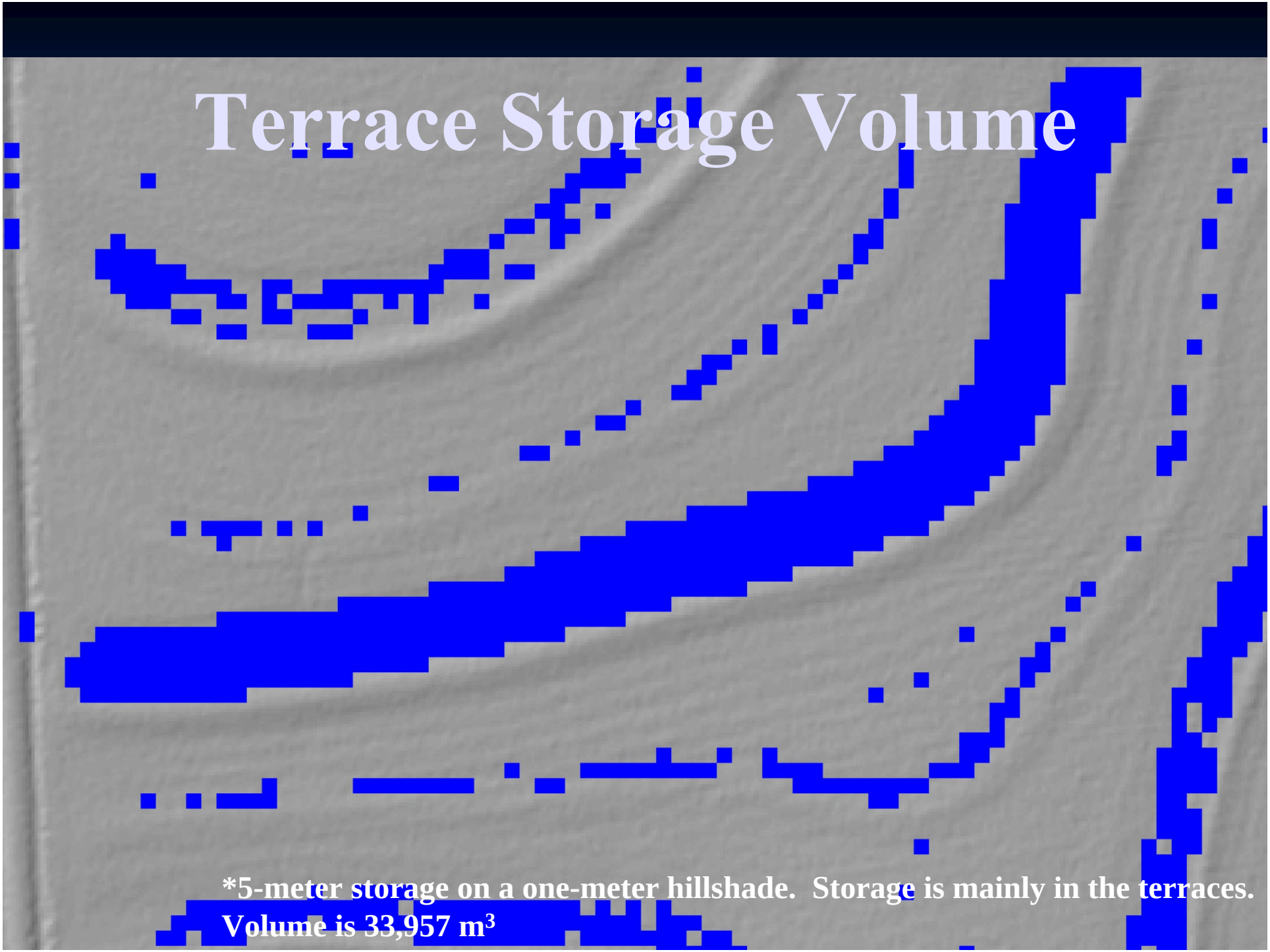
Elevation Contours - LIDAR



Terrace Storage Volume

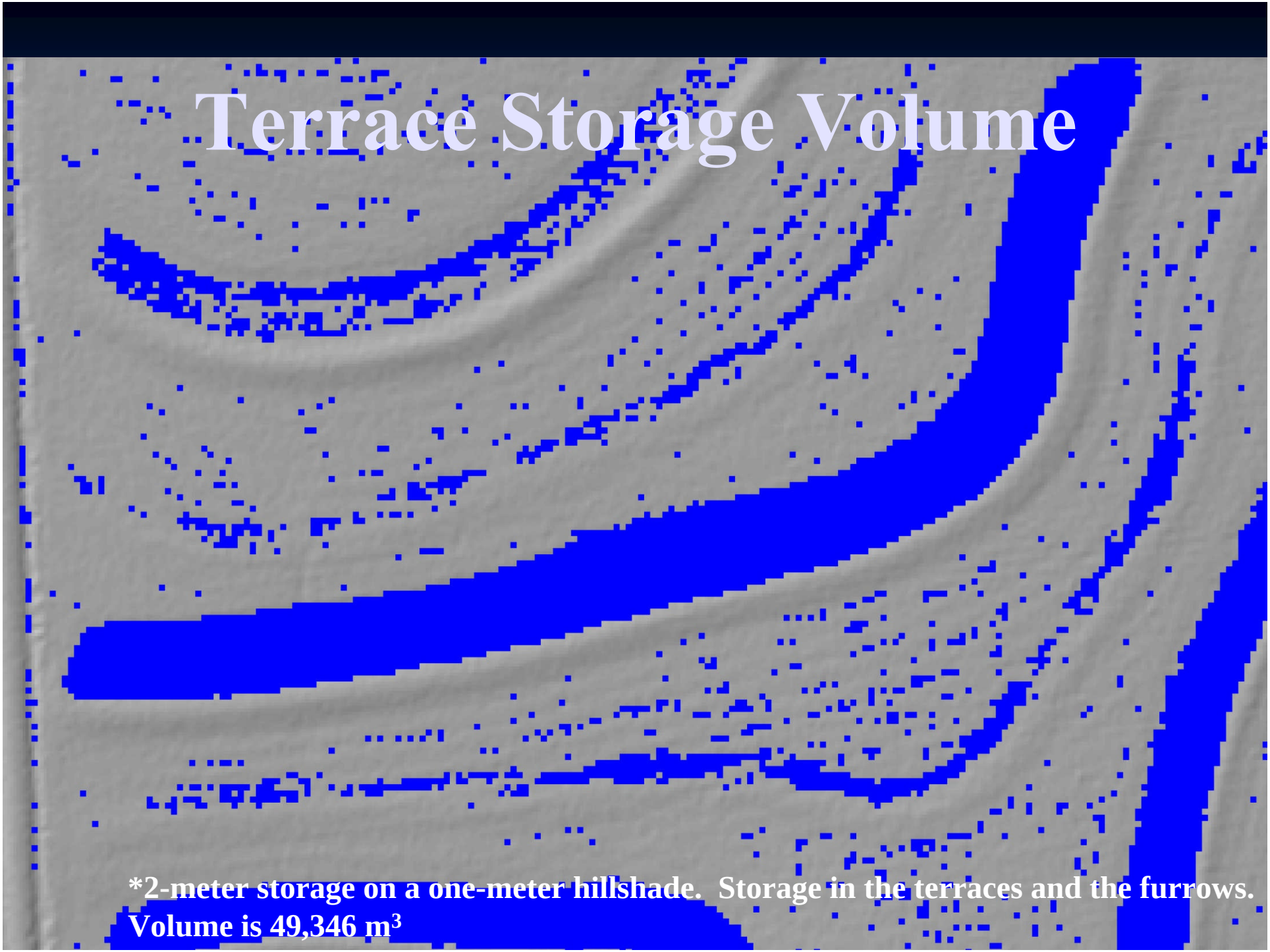
***One-meter hillshade. Terraces and furrows are visible**

Terrace Storage Volume



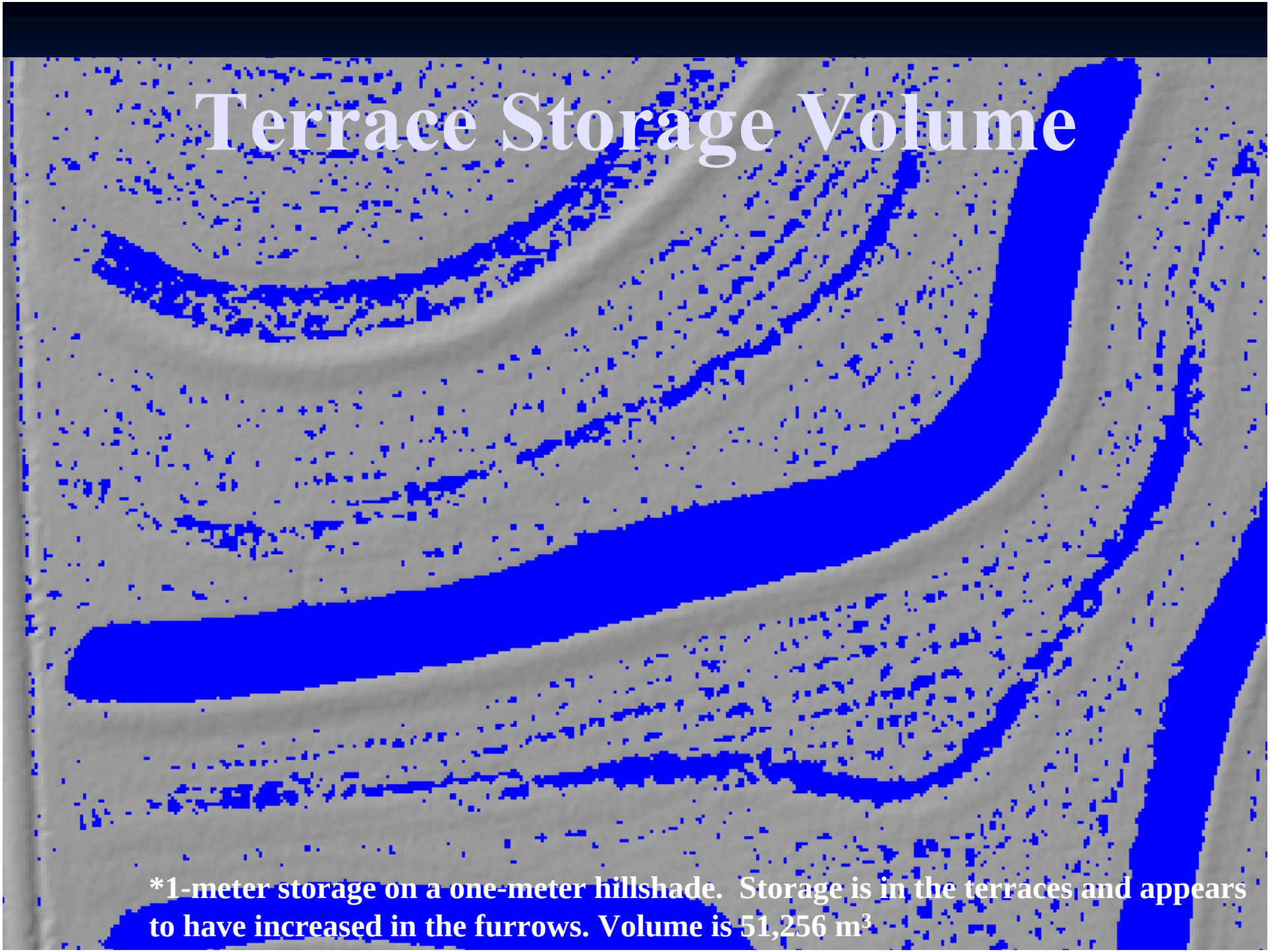
***5-meter storage on a one-meter hillshade. Storage is mainly in the terraces. Volume is 33,957 m^3**

Terrace Storage Volume

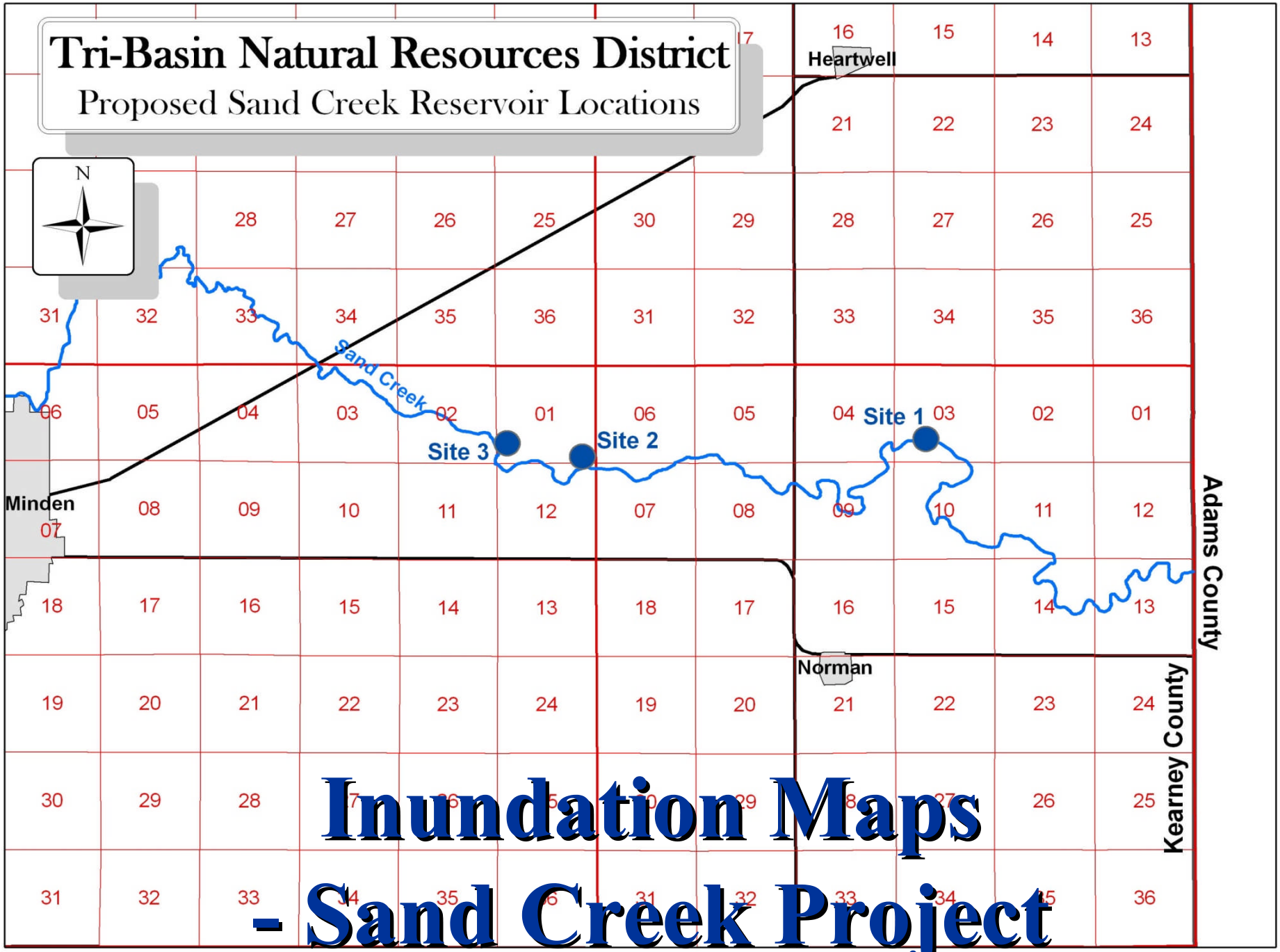


*2-meter storage on a one-meter hillshade. Storage in the terraces and the furrows. Volume is 49,346 m^3

Terrace Storage Volume



***1-meter storage on a one-meter hillshade. Storage is in the terraces and appears to have increased in the furrows. Volume is 51,256 m^3**



Inundation Maps - Sand Creek Project

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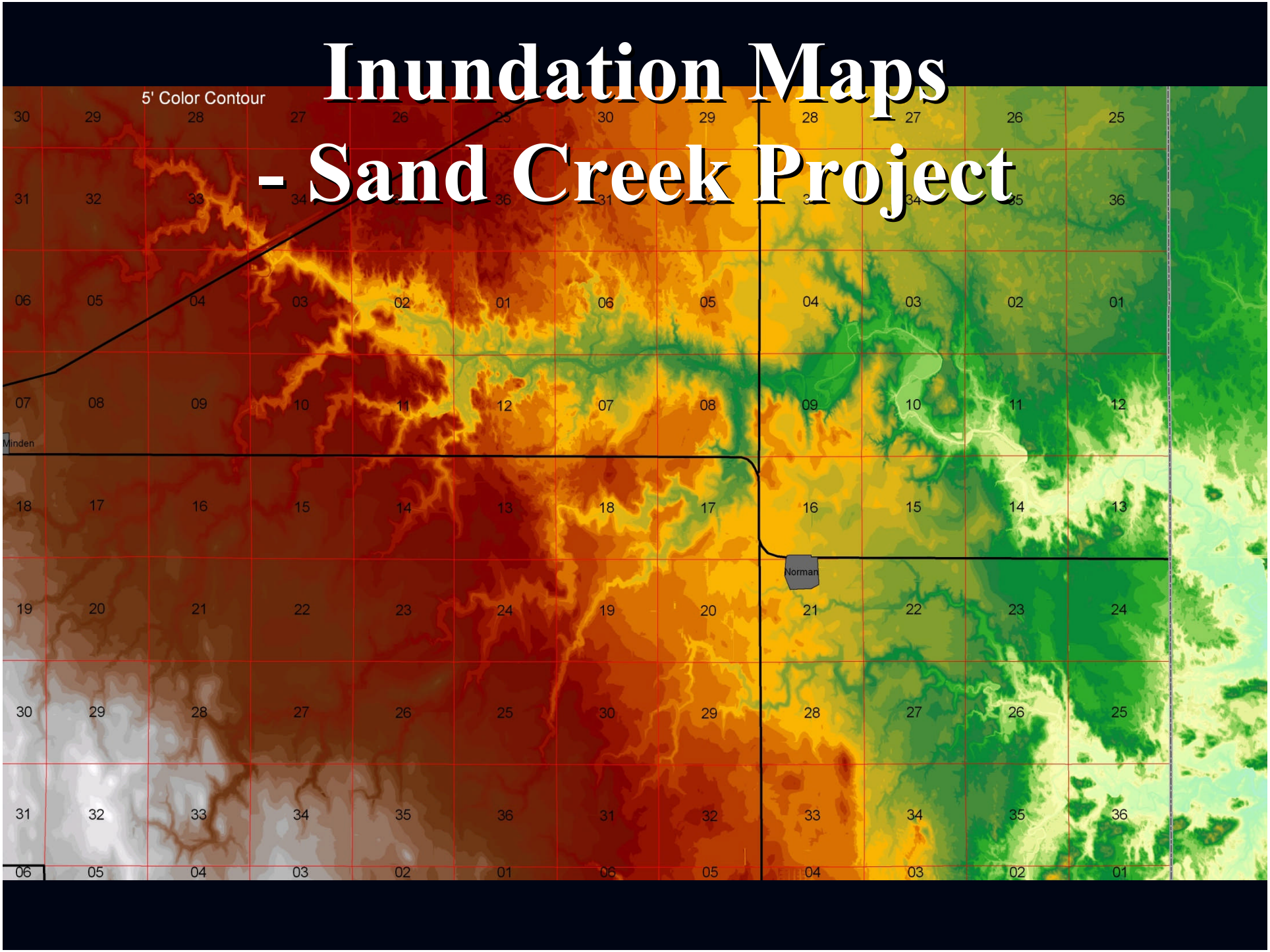
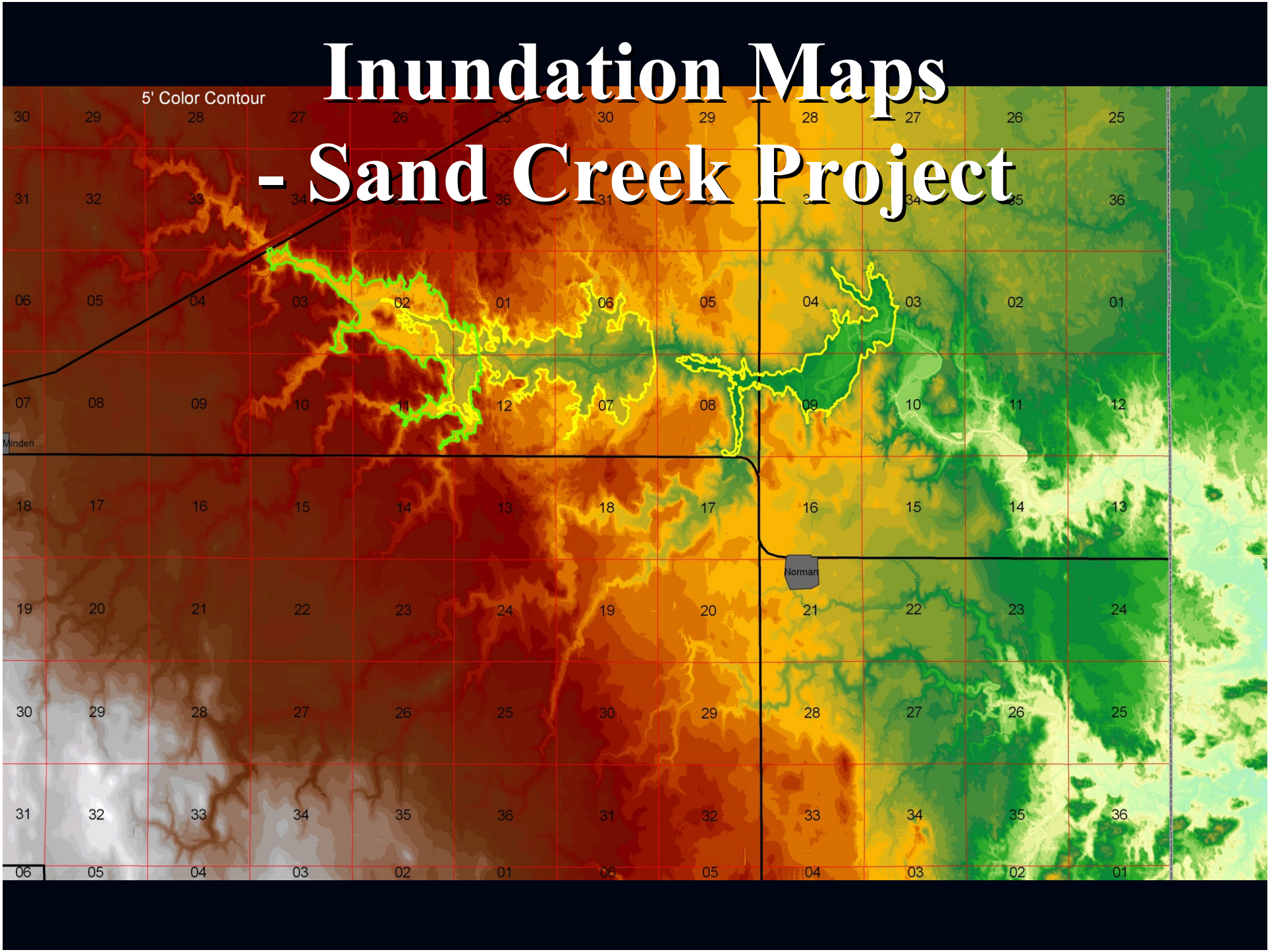
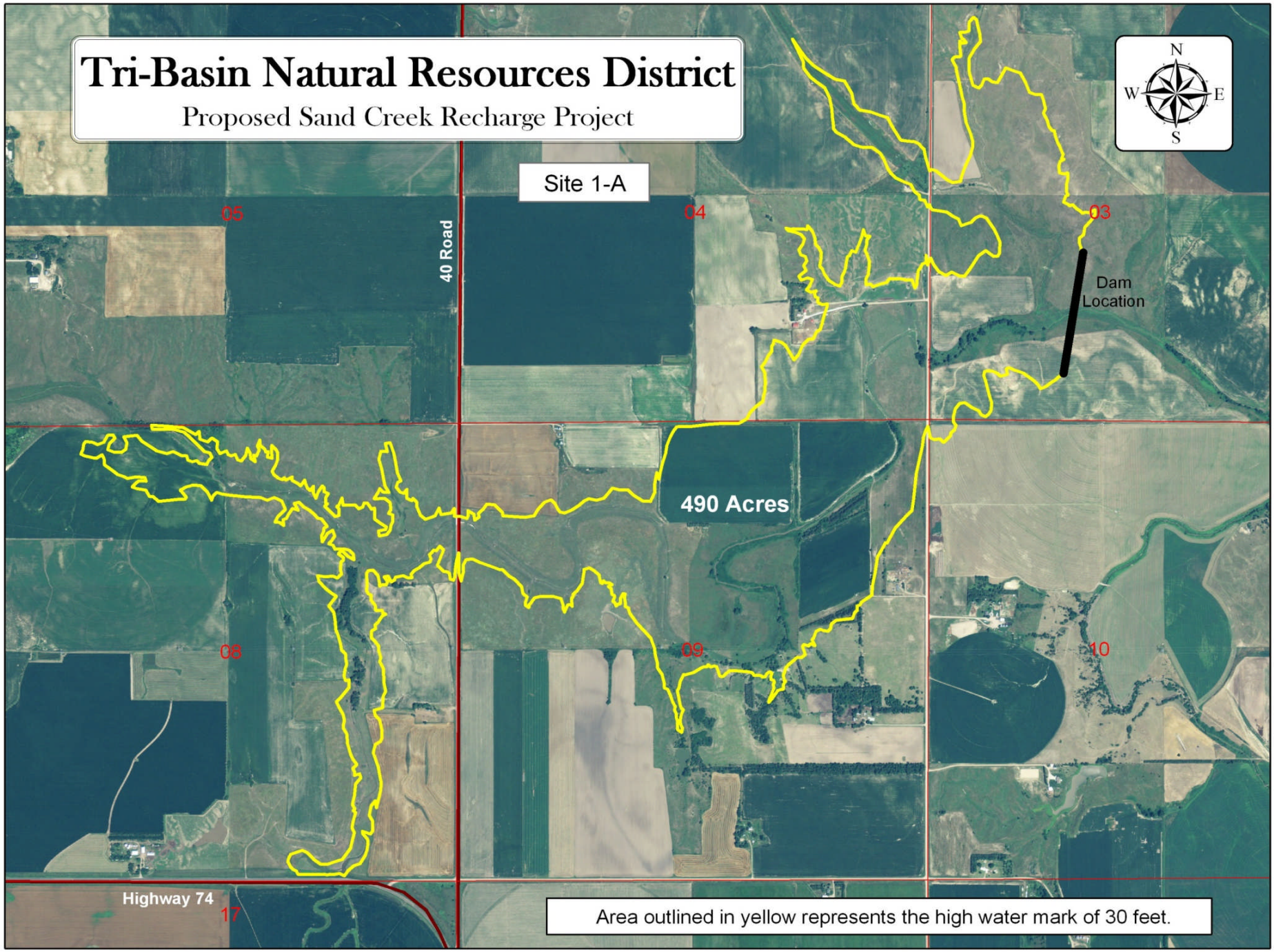
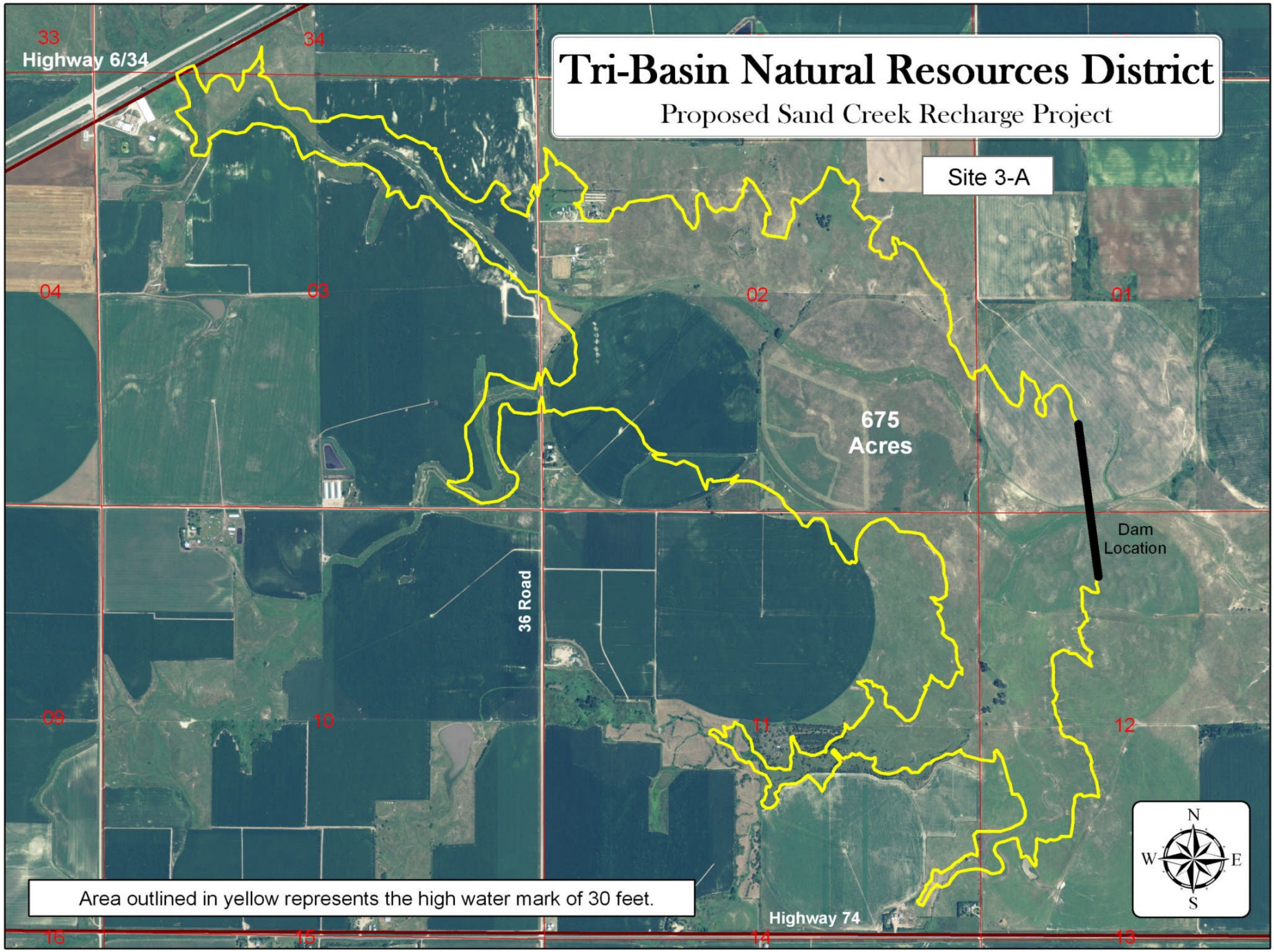
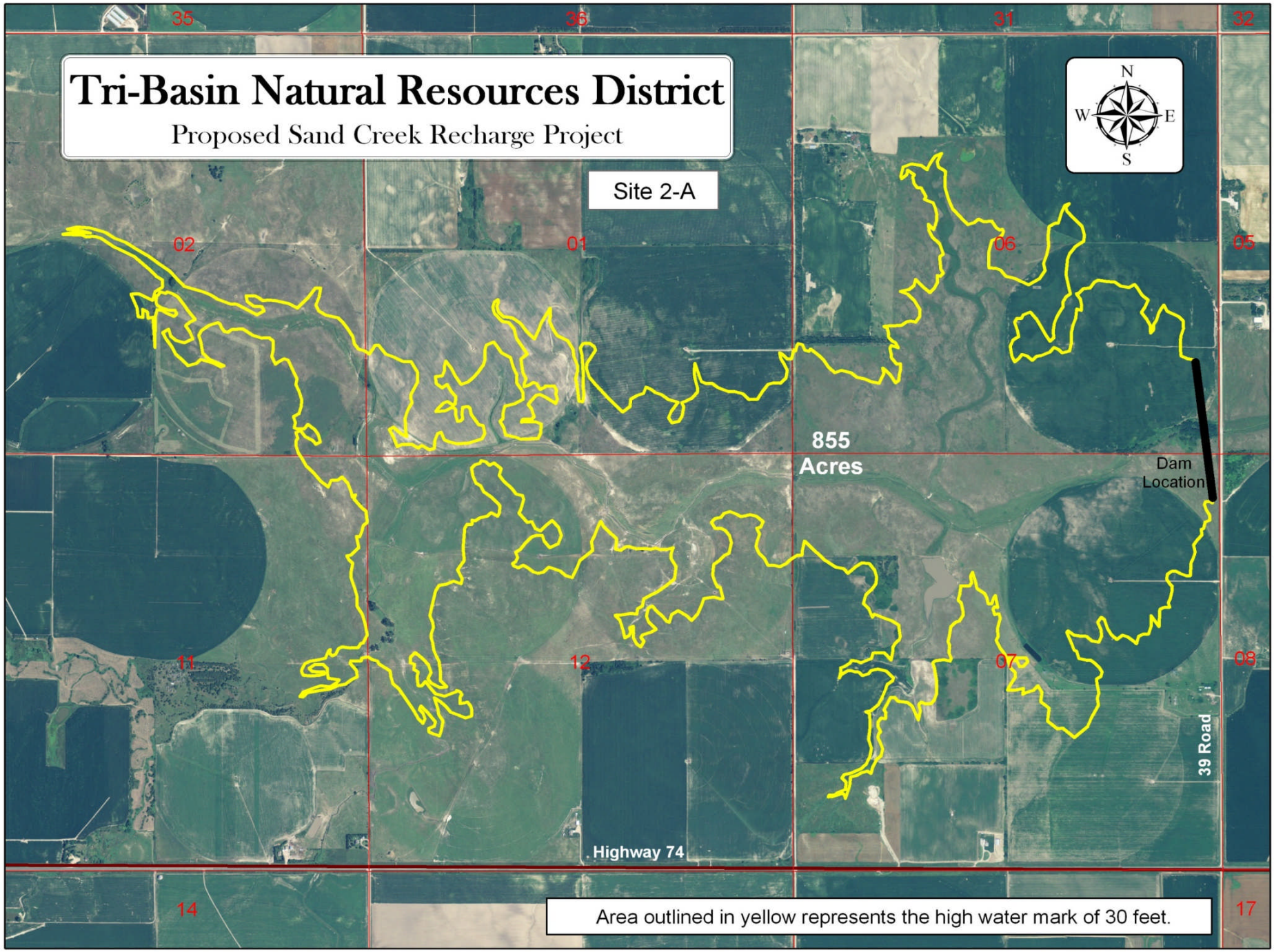


Inundation Maps - Sand Creek Project

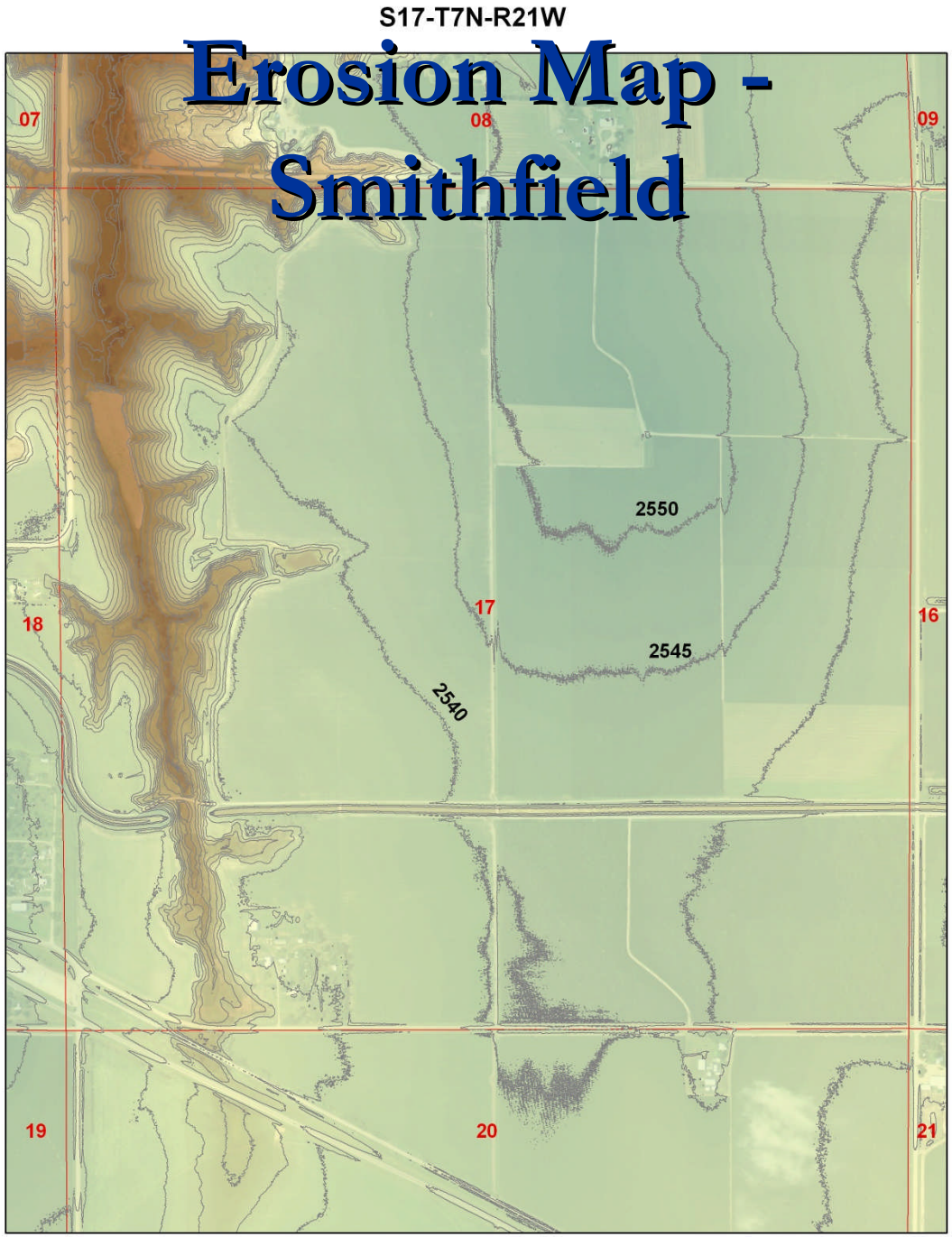



Tri-Basin Natural Resources District
Proposed Sand Creek Recharge Project
Site 1-A
N
W
E
S
05
04
03
40 Road
Dam
Location
490 Acres
08
09
10
Highway 74
17
Area outlined in yellow represents the high water mark of 30 feet.

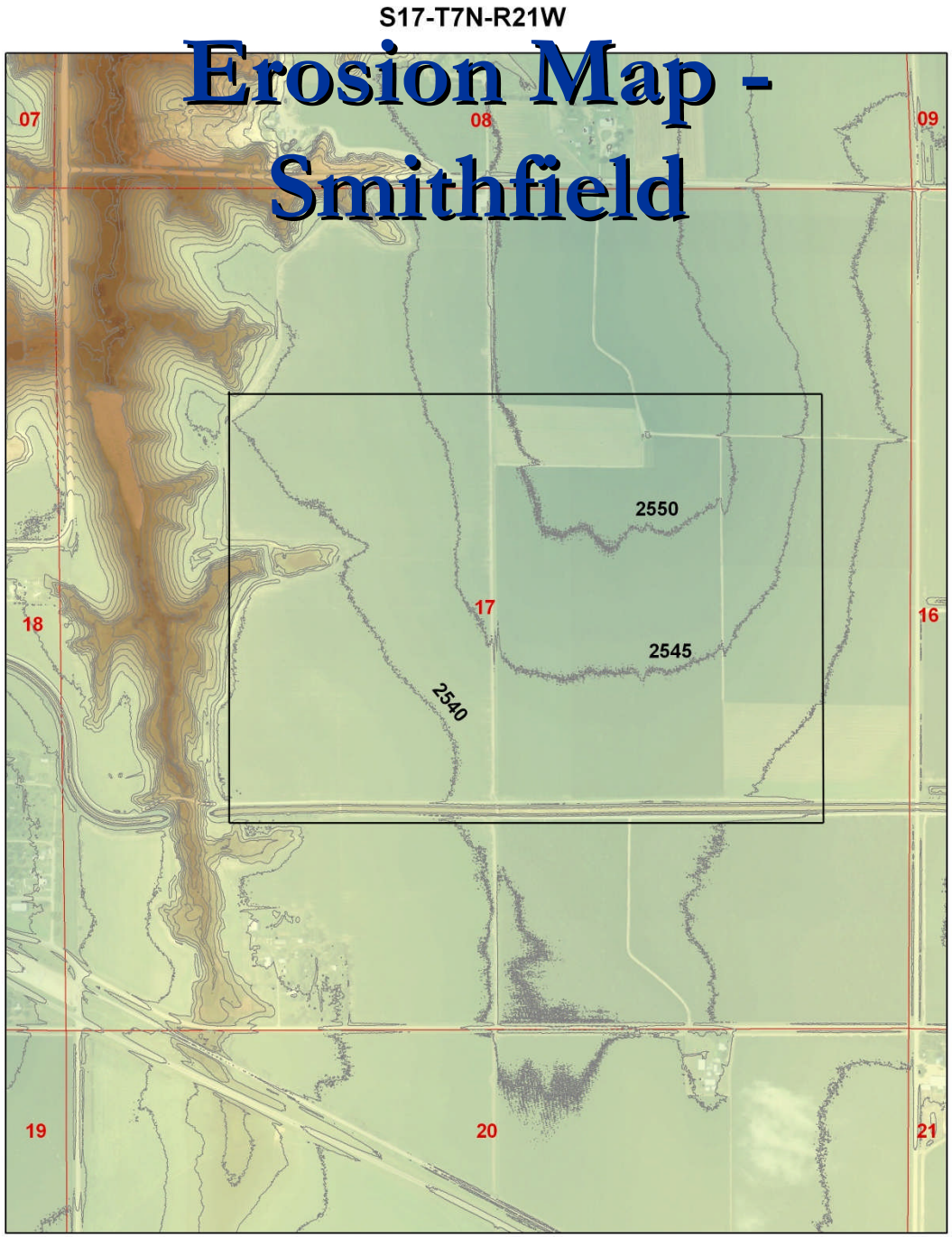

Tri-Basin Natural Resources District
Proposed Sand Creek Recharge Project
Site 3-A
675
Acres
Dam
Location
Highway 6/34
36 Road
Highway 74
33
34
04
03
02
01
09
10
11
12
16
15
14
13
N
W
E
S
Area outlined in yellow represents the high water mark of 30 feet.


Tri-Basin Natural Resources District
Proposed Sand Creek Recharge Project
Site 2-A
N
W
E
S
35
36
31
32
02
01
06
05
11
12
07
08
14
17
855
Acres
Dam
Location
39 Road
Highway 74
Area outlined in yellow represents the high water mark of 30 feet.

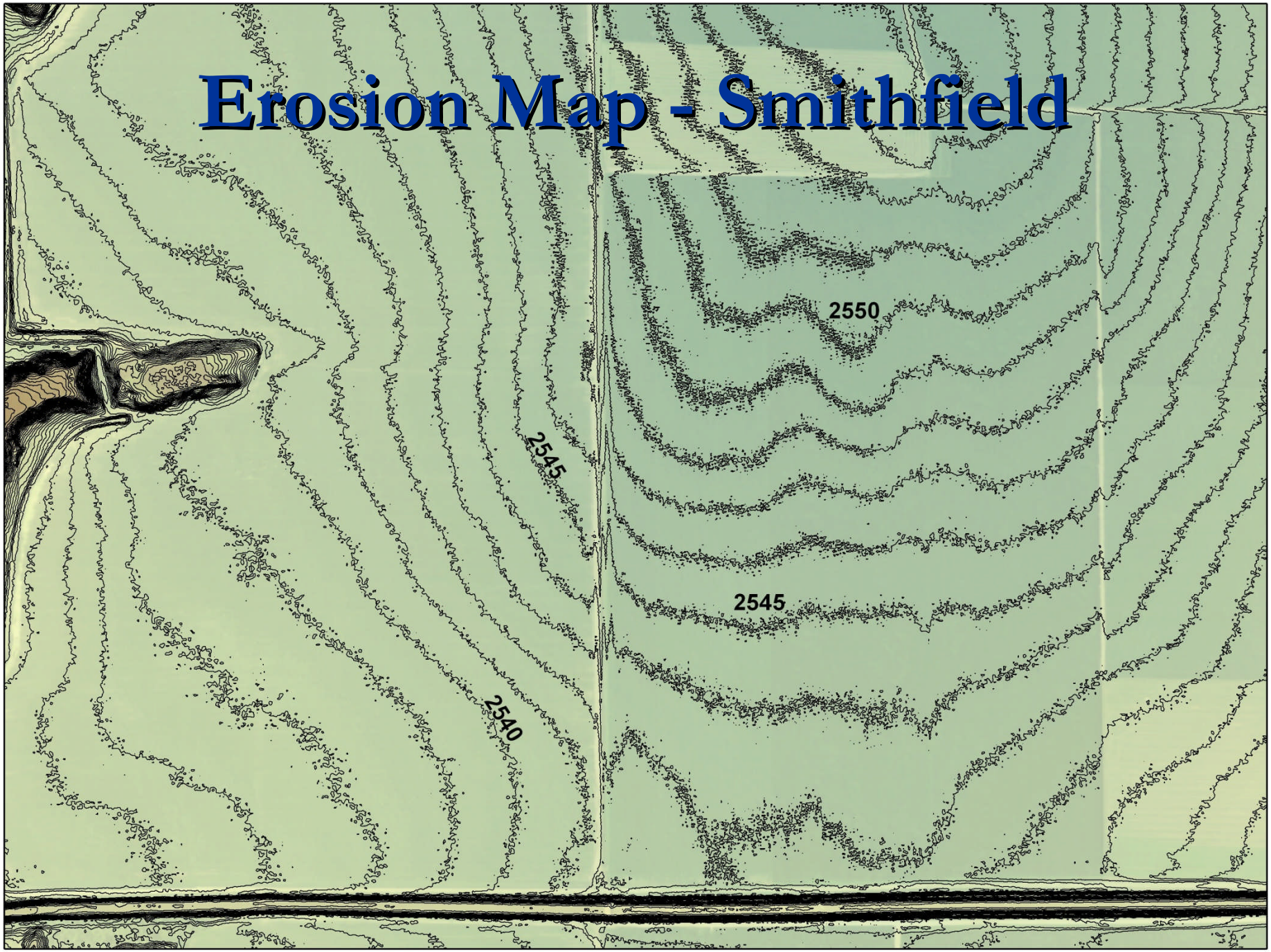
Erosion Map - Smithfield



Erosion Map - Smithfield



Erosion Map - Smithfield



Floodplain Mapping

NDNR has developed tools for the automated mapping of floodplains within ArcView and ArcGIS that relies on elevation for both hydrology and hydraulics.

The N-FACT tools have increased floodplain map production from 1/10th a mile per hour in 1999, to about 5 miles per hour in 2003.

Data Inputs and Outputs

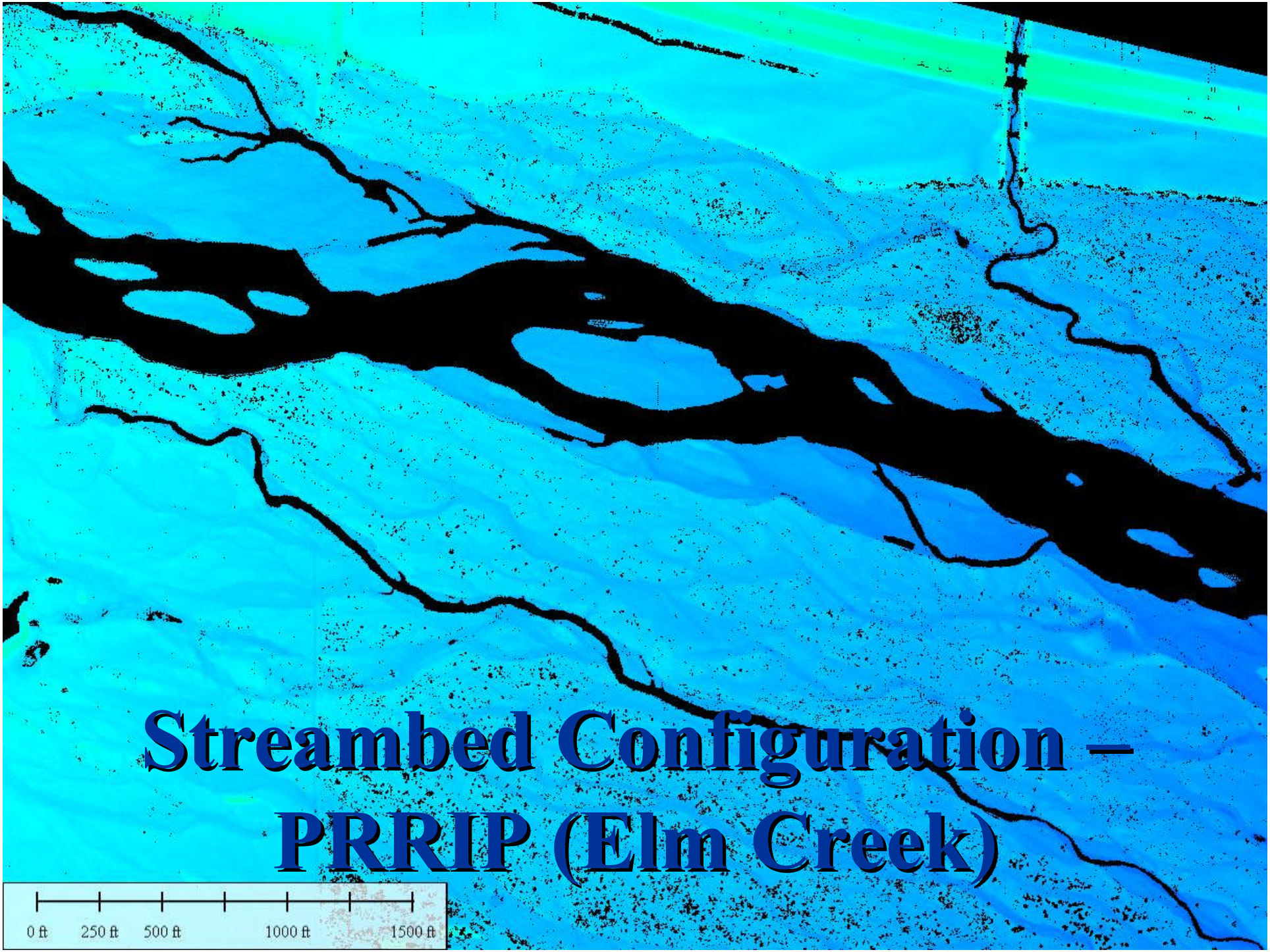
Step	Input Data	Output Data/Product
1	30-meter DEMs	Filled DEM Grid Flow Direction Grid Flow Accumulation Grid Flow Length Grid
2	10-foot Elevation Contours or USGS Digital Raster Graphics	10-foot Elevation Contour Shapefile
3	Flow Accumulation Grid 10-foot Elevation Contours	Digitized Stream Shapefile
4	Filled DEM Grid Flow Direction Grid Flow Accumulation Grid Flow Length Grid 10-foot Elevation Contours Digitized Streams	Digitized Cross-Section Shapefile Stream Slope Shapefile Base Flood Elevation Contour Shapefile
5	10-foot Elevation Contours Digitized Streams Digitized Cross-Sections Base Flood Elevation Contours	Approximate Flood Zone Shapefile

(Shafer, J. and Williams, J., 2003. Breaking the 5-mile per hour barrier: Automated mapping using a normal depth calculation.)

Floodplain Mapping

Digitizing stream lines and cleaning up floodplain delineations accounts for about 85% of the time and cost for producing approximate floodplain delineations.

New high-resolution elevation data should significantly decrease this cost.



Streambed Configuration – PRRIP (Elm Creek)

Streambed Morphology and Configuration – PRRIP (GI)

What can it do for us?

- Detailed Survey Elevation >One Million Points/Square Mile
- Floodplain Contours
- Vegetation Classification (when combined w/ imagery)
- Inundation Mapping
- Change Mapping
- Streambed Morphology
- Other?

Thank You

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