USGS
science for a changing world

National Geospatial Technical Operations Center (NGTOC)

USGS Quality Assurance (QA) How LiDAR is Evaluated

Missouri GIS Advisory Committee's

Advanced LiDAR Workshop

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Background

National GeoSpatial Program (NGP)

http://www.usgs.gov/ngpo/

Organize, maintain, and publish the geospatial baseline of the Nation's topography, natural landscape, and built environment

http://www.nationalmap.gov

http://www.nationalatlas.gov

Background

National Geospatial Technical Operations Center (NGTOC)

http://ngtoc.usgs.gov/

NGTOC provides essential support for the acquisition and management of trusted geospatial data, products, and services through world-class geospatial technical expertise and customer service for the U.S. Geological Survey and the Nation.

Background

Lidar at USGS

For decades, stereo Photogrammetry was the technology of choice for producing topographic data.

Lidar was first used as an alternative technology to photogrammetry for collecting elevation data.

Background

Lidar at USGS

NGP is interested in Digital Elevation Models (DEMs) for seamless nationwide elevation coverage for the National Map National Elevation Dataset (NED).

In the past the focus of QA was very DEM-centric.

Background

Lidar at USGS

In addition to the bare-earth DEMs, Lidar is a rich data source, with value far beyond elevation data only.

We wanted to preserve more of that information for other scientific uses.

Background

Contract Specifications

Contracts for the American Reinvestment & Recovery Act (ARRA) were the first to include extant

U.S. Geological Survey National Geospatial Program

Base Lidar Specification in the contract requirements.

Background

Lidar at USGS

- Point Clouds and DEMs
- 2 Goals Achieved:
- Elevation for NGP mission
- Preservation of LAS for other uses

Lidar QA

Goals

- Ensure accuracy of deliverables – not easy to achieve
- Fulfill our end of partnership agreements
- Maintain reputation as leader in geospatial industry

Lidar QA

Challenges

Data from a variety of sources

Contracts

Partnerships

"Over the fence"

Lidar QA

Deliverables

- Reports & Ancillary Data
  - QA/QC Report, Collection, Survey
  - Project Boundary, Tiling Scheme, Check Points
- LAS Swath Files
- Classified LAS Tile Files
- FGDC Compliant Metadata
  - Swath LAS, Classified LAS Tiles
- Tiled DEM Files
- Breaklines
- Possible Additional Deliverables

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Lidar QA

Software tools used

- ArcMap
- Global Mapper
- LP360
- Metadata Parser
- Command line tools
- Ultra Edit
- Ultra Compare

Lidar QA

Ancillary Data used

- Ortho Imagery
- Digital Raster Graphics (DRG)
- Google Maps

Lidar QA

Variety of Rendering/Viewing Techniques

- Shaded Relief
- Color Ramp
- 3D Views
- Contours

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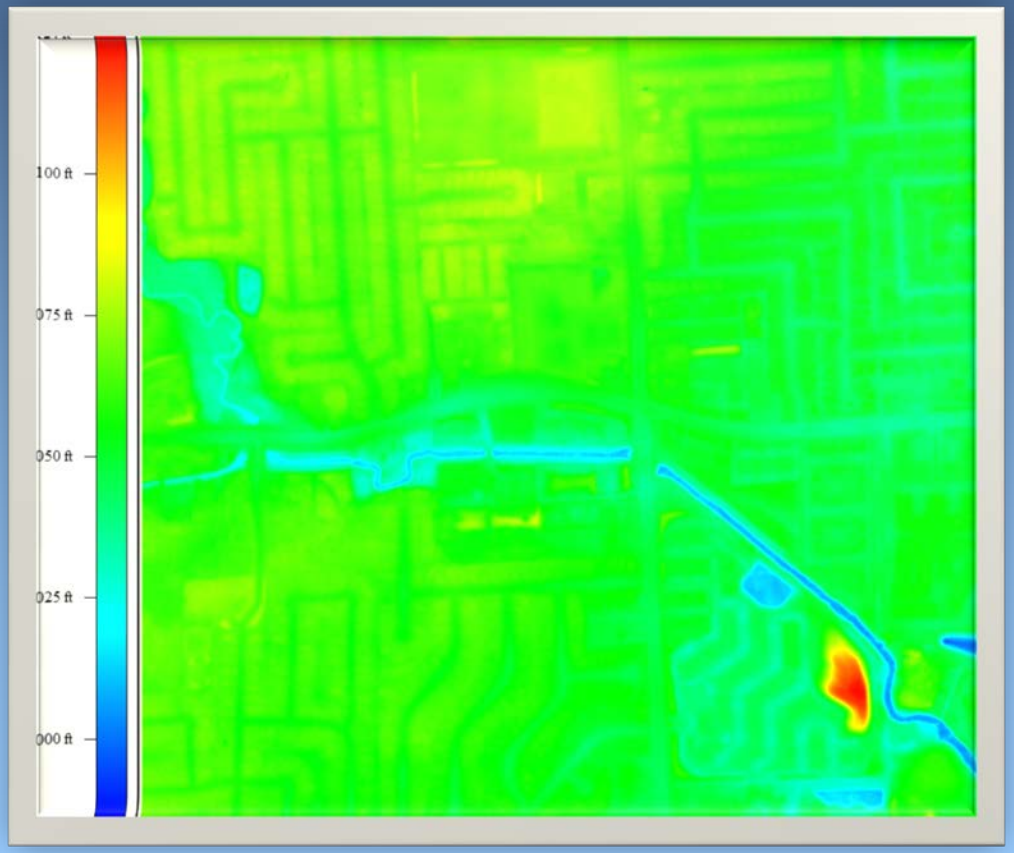

Lidar QA

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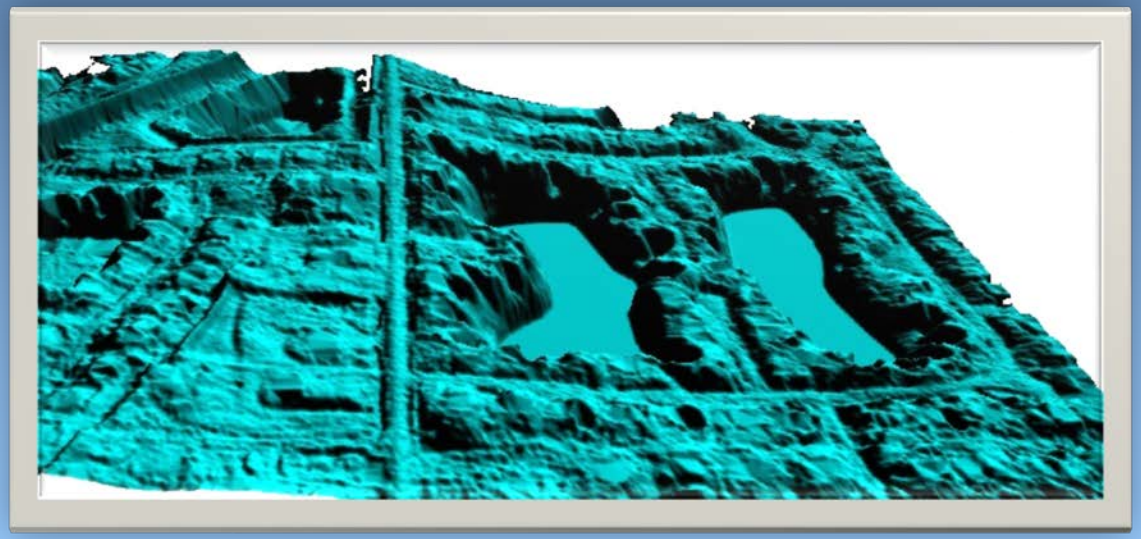

Lidar QA

Global Checks

- Applies to all geospatial deliverables
  - Coordinate Reference System
  - Datum
  - Units

LiDAR QA

Swath LAS Files

- ✓ Vertical Accuracy
  - Vertical Accuracy (FVA)
- ✓ Extents
- ✓ File Sizes
- ✓ Compliance with LAS format specifications
- ✓ Swath Edge markers
- ✓ Sufficient Overlap

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Lidar QA

Classified LAS Tiles

- ✓ Adhere to Tiling Scheme/Naming Convention
- ✓ Correct Classification
- ✓ Conform to LAS File Format Specifications

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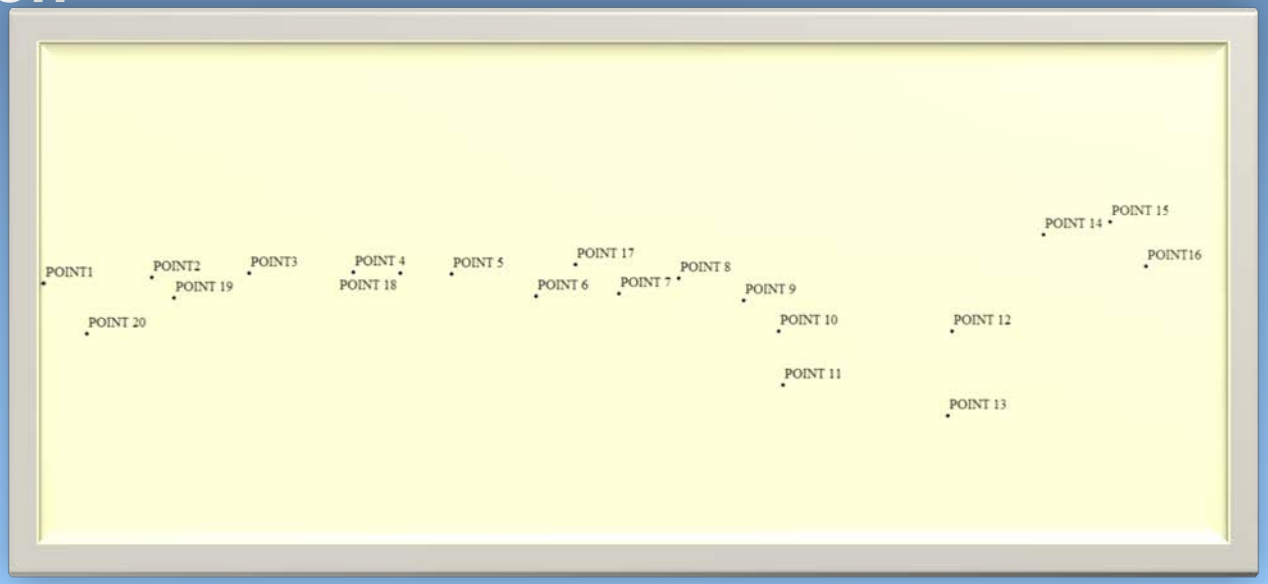
Lidar QA

Check Points

- ✓ Sufficient Quantity
- ✓ Required Point Classes
- ✓ Distribution



Lidar QA

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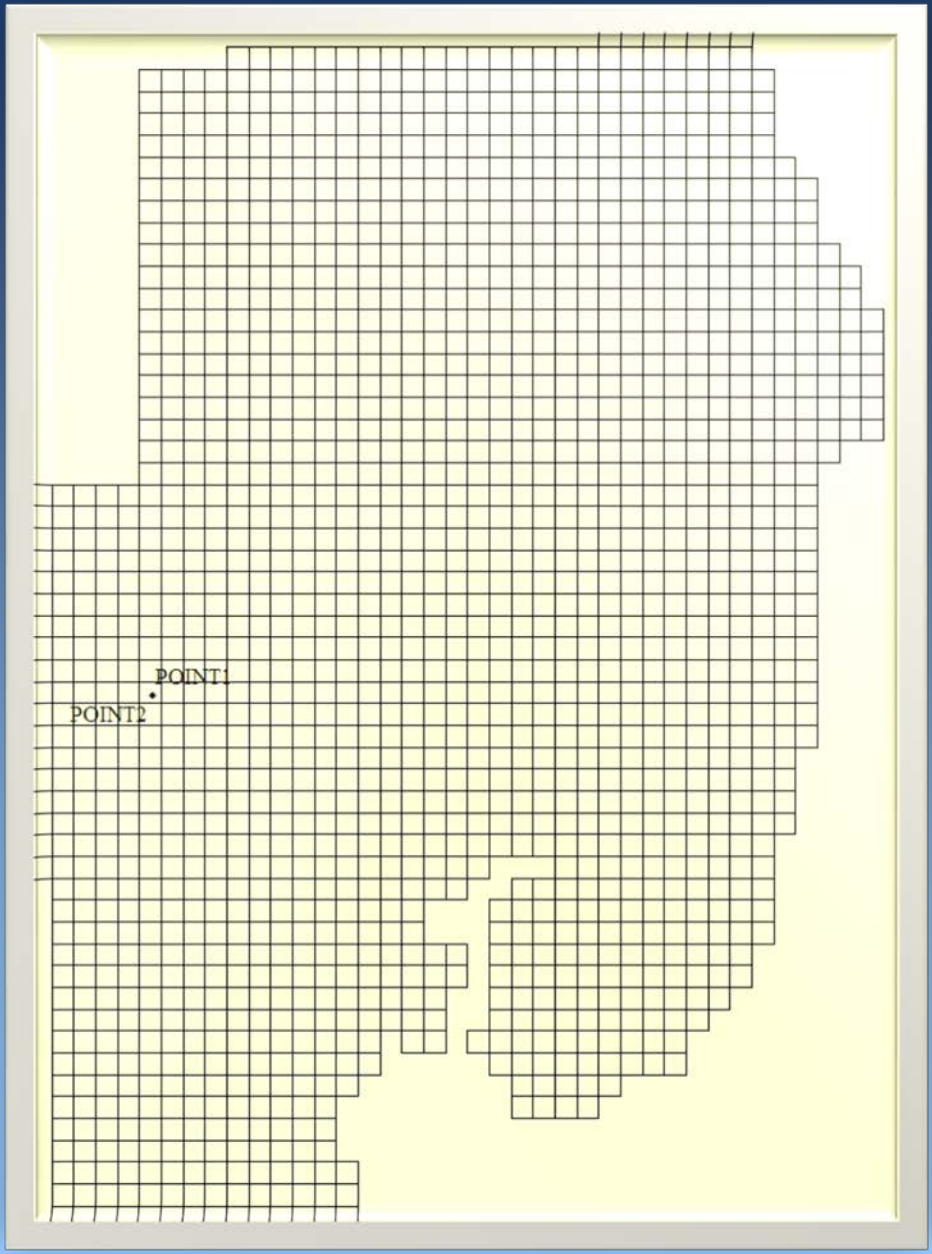

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Lidar QA

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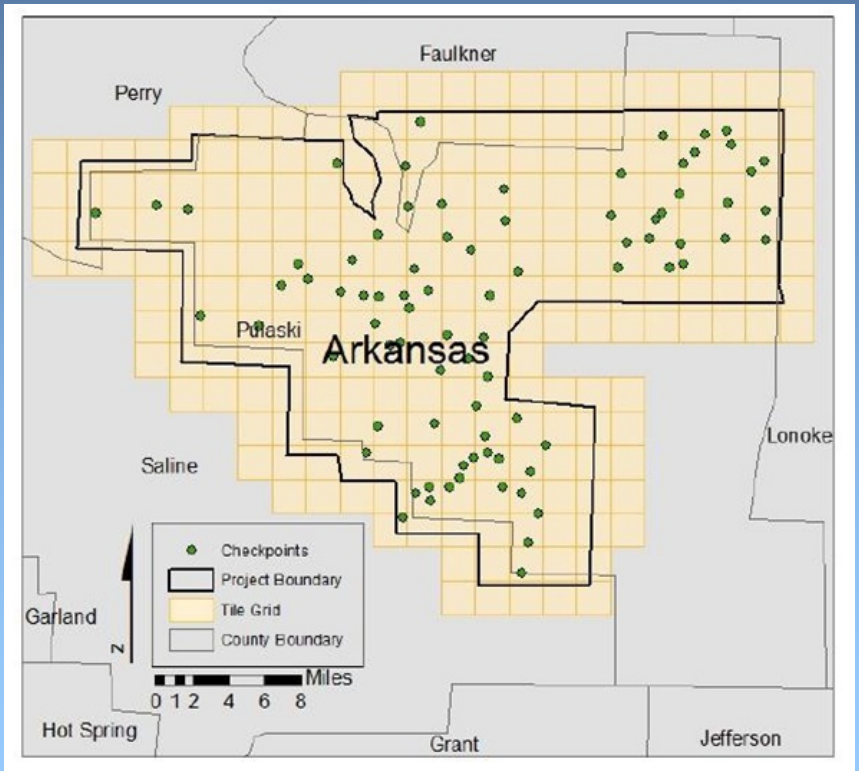

Lidar QA

Breaklines

- Used for Hydro Flattening
- Rivers

Lidar QA

DEM Checks

- ✓ Adhere to Tiling Scheme and Naming Convention
- ✓ No Gaps, Overlap, Or Missing Data
- ✓ Hydroflattened correctly
- ✓ Removal non-ground features
  - ✓ Bridges
  - ✓ Buildings
  - ✓ Vegetation
- ✓ Seam lines
- ✓ Artifacts and Anomalies

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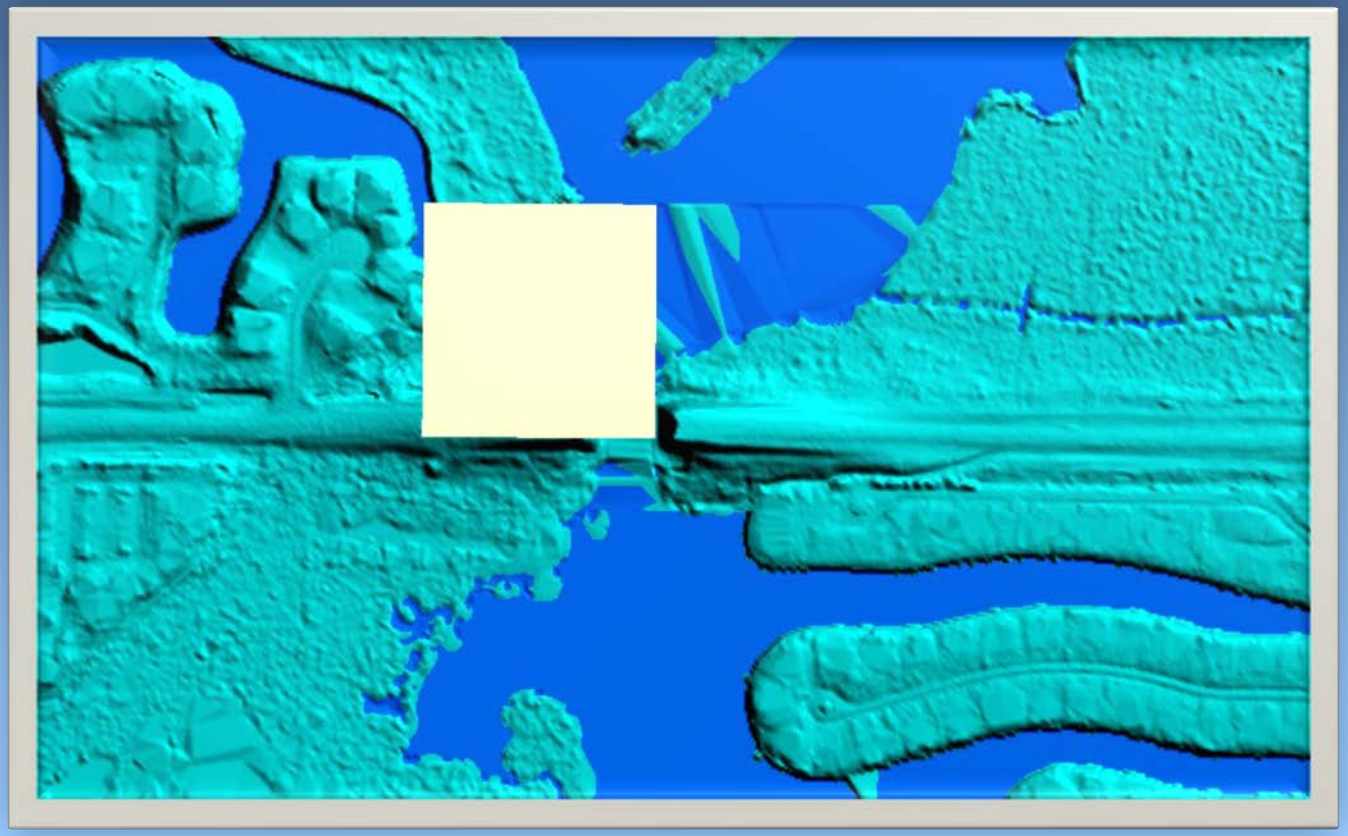
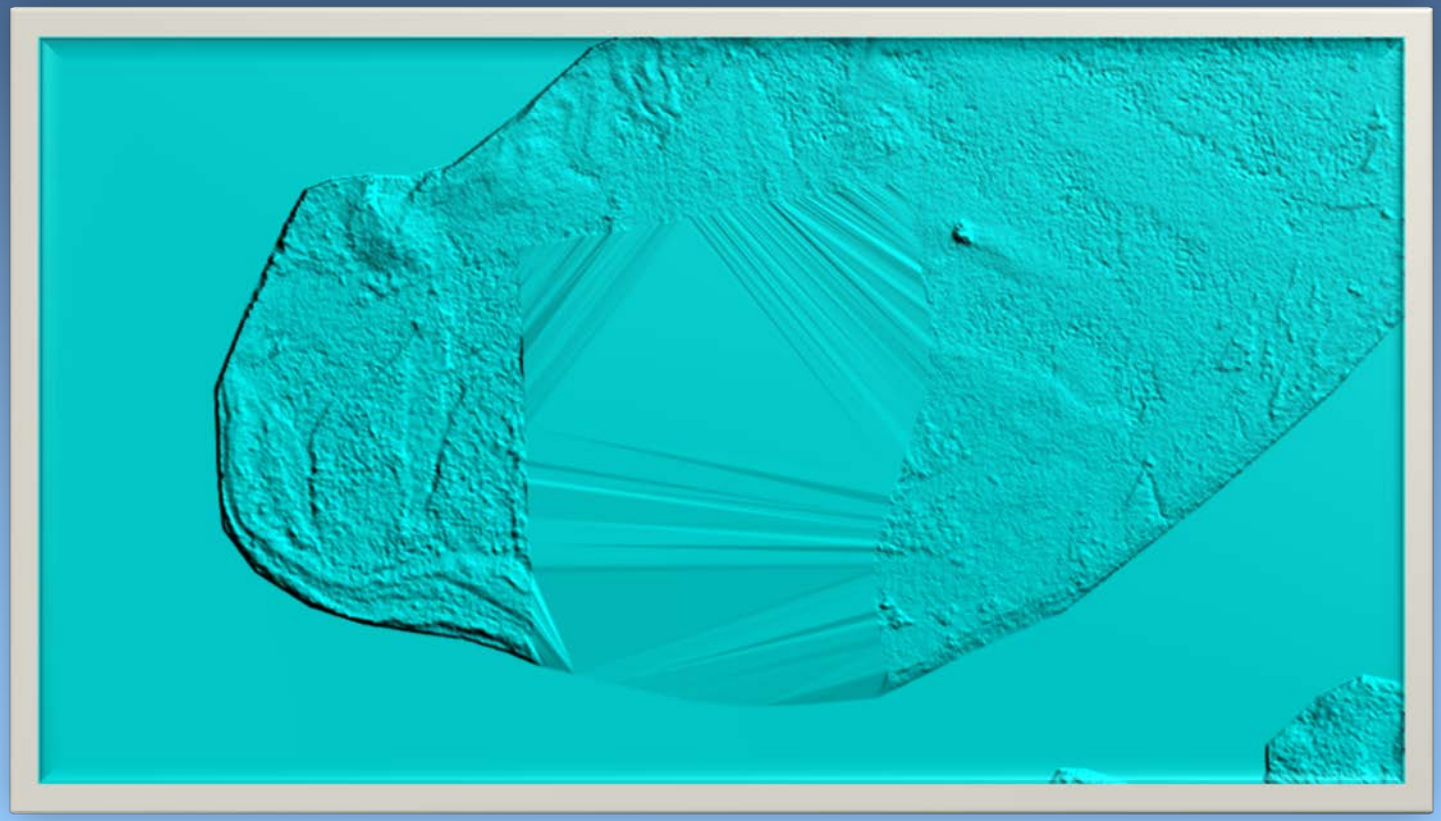
Example Screenshots Lidar QA

DEM Checks – Missing Data - Void Areas



Example Screenshots Lidar QA

DEM Checks – Missing Data - Triangulation



Example Screenshots Lidar QA

DEM Checks – Hydro Flattening Errors

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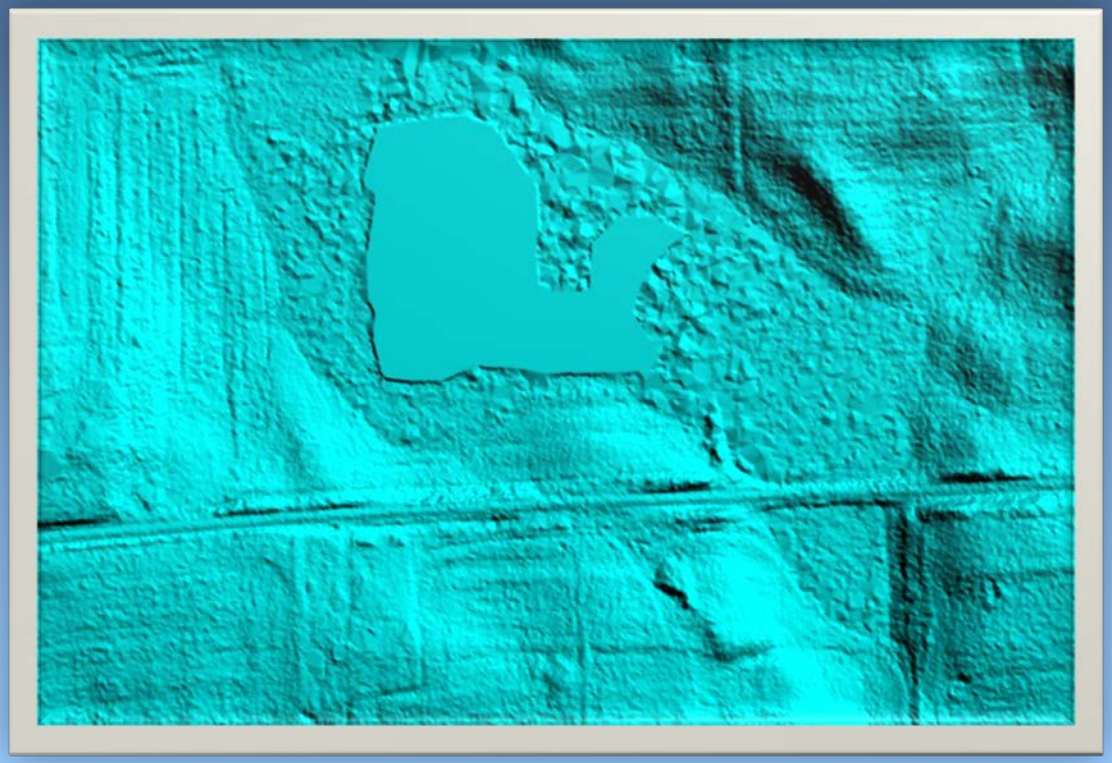

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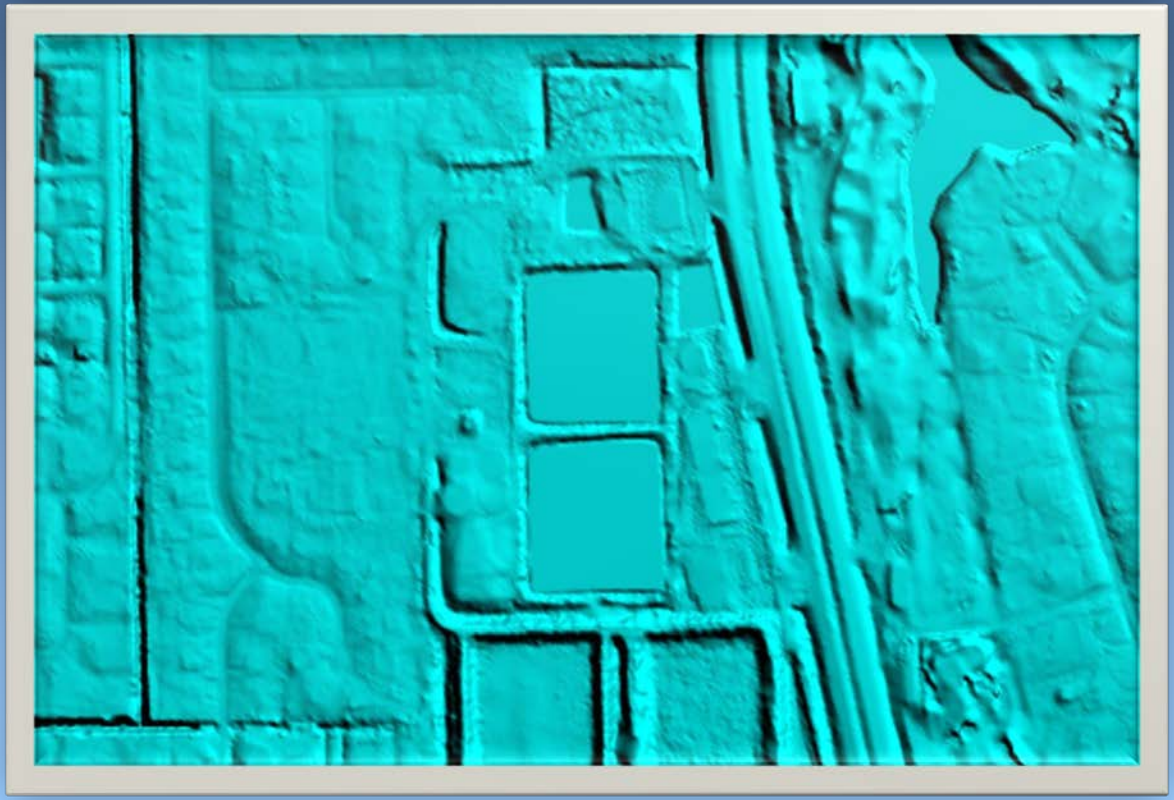

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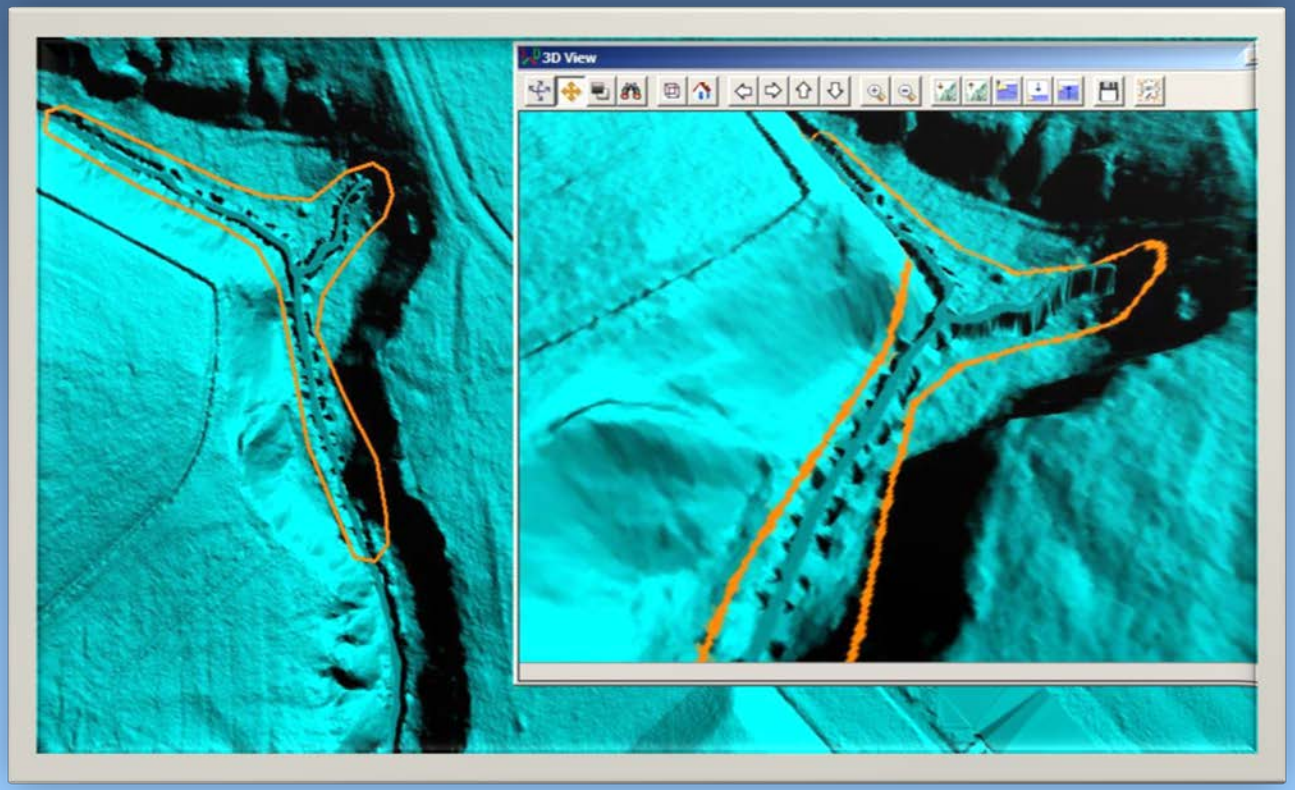
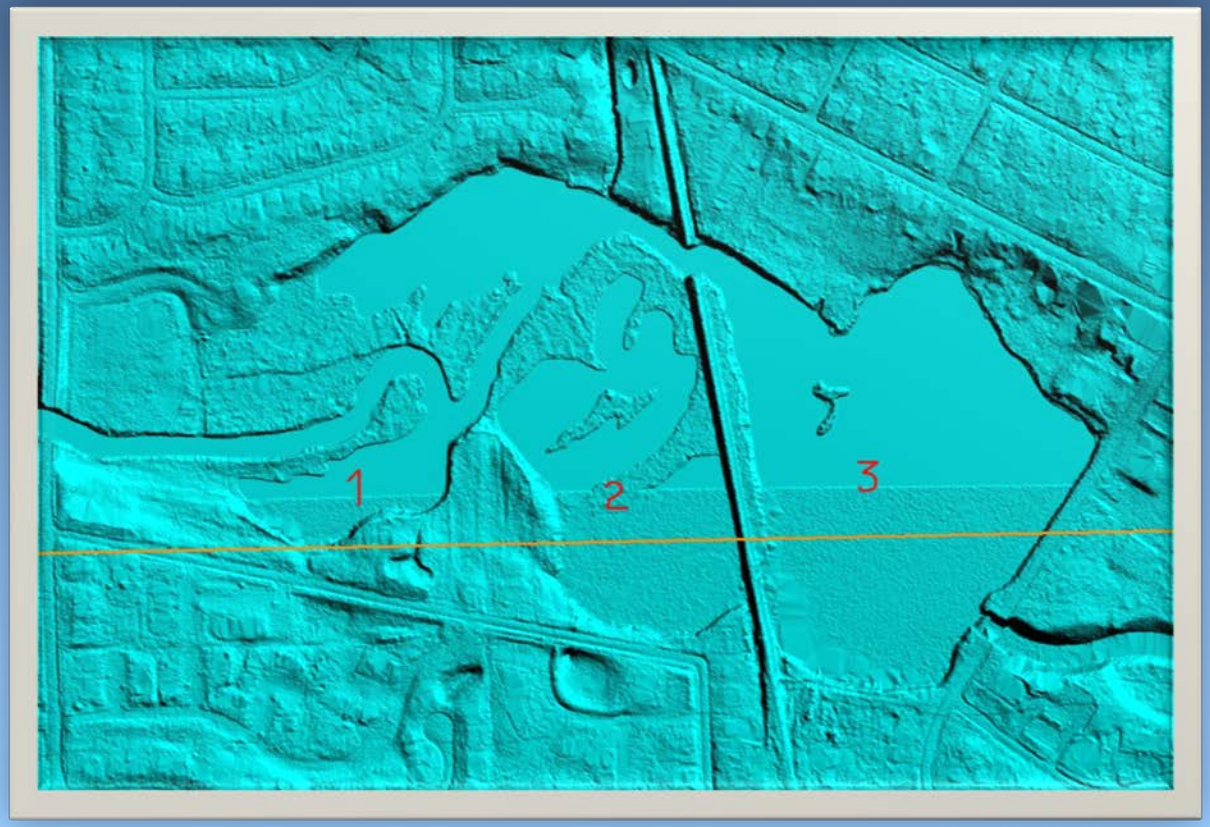


Example Screenshots Lidar QA

DEM Checks – Seams, Flattening



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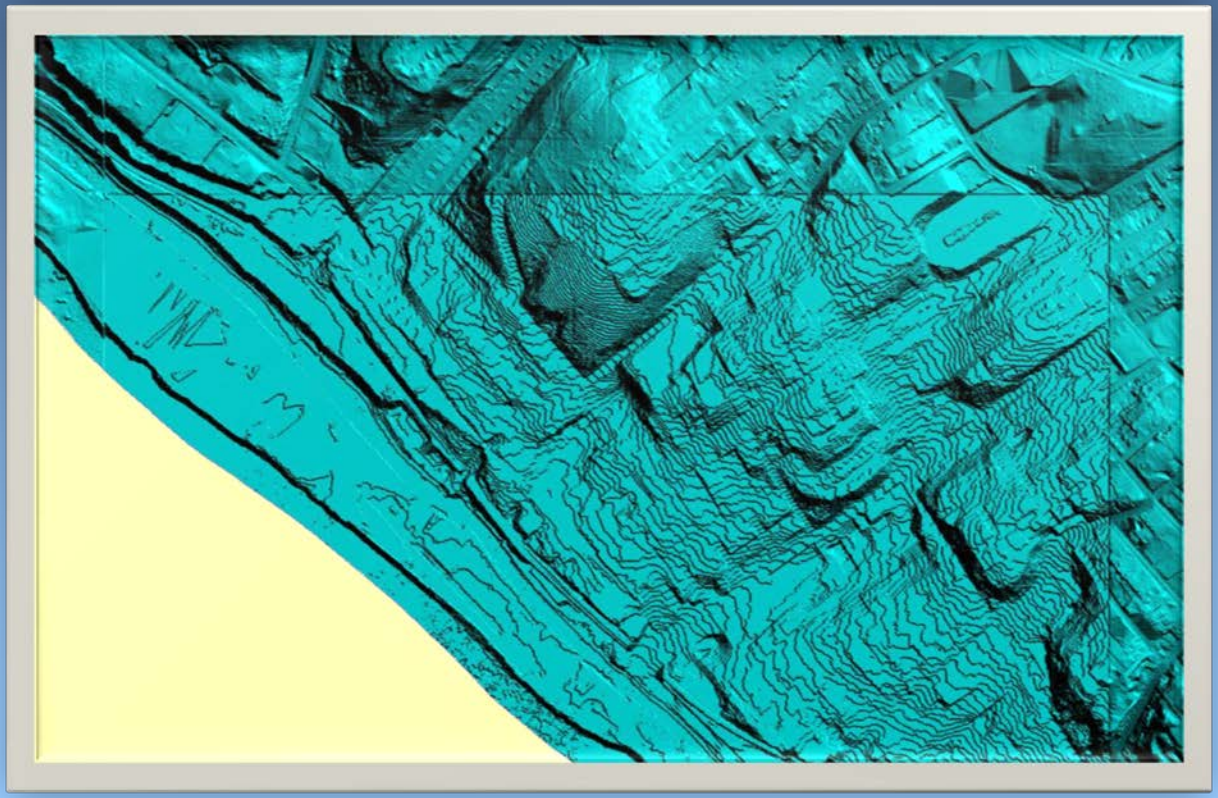
DEM Checks - Seams, Terracing



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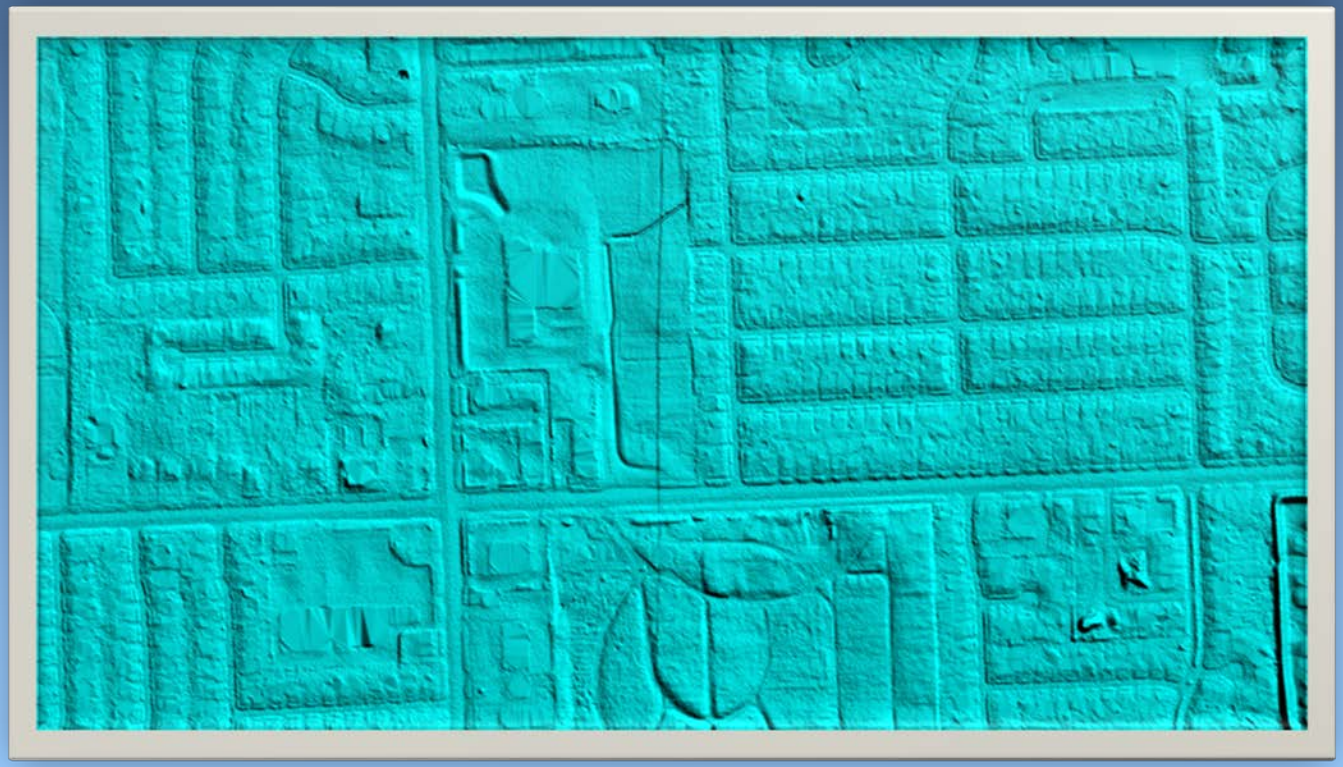
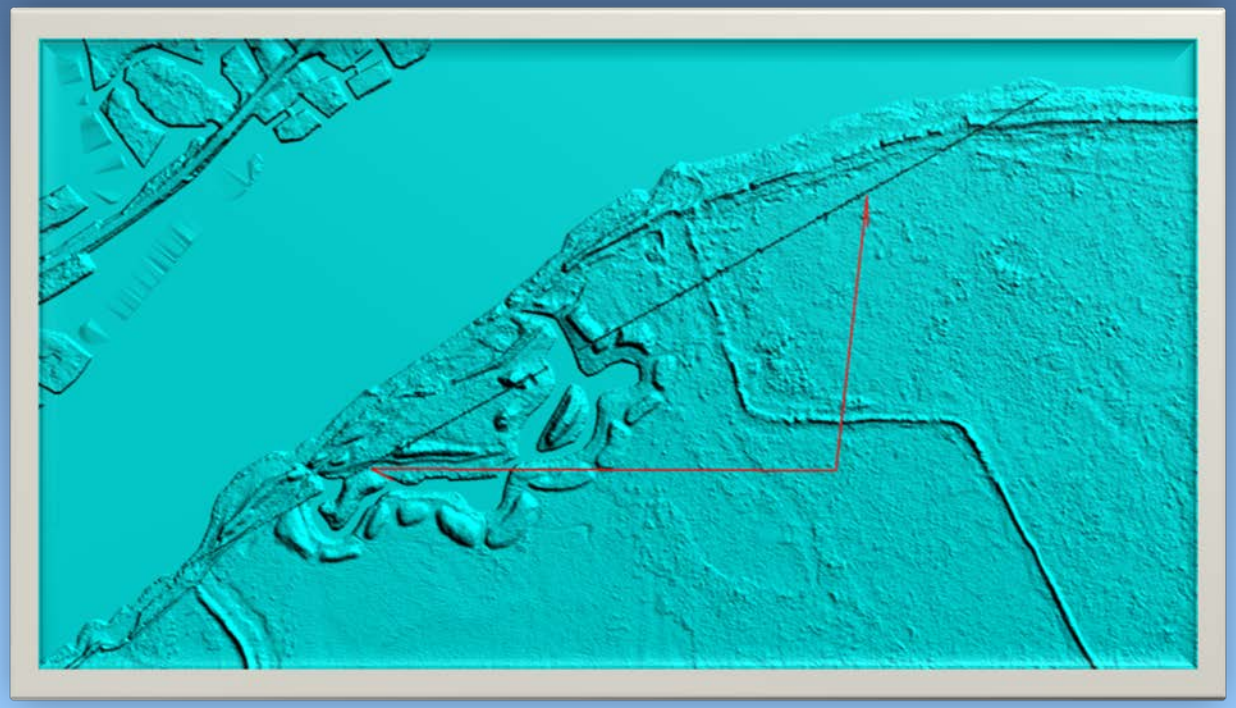


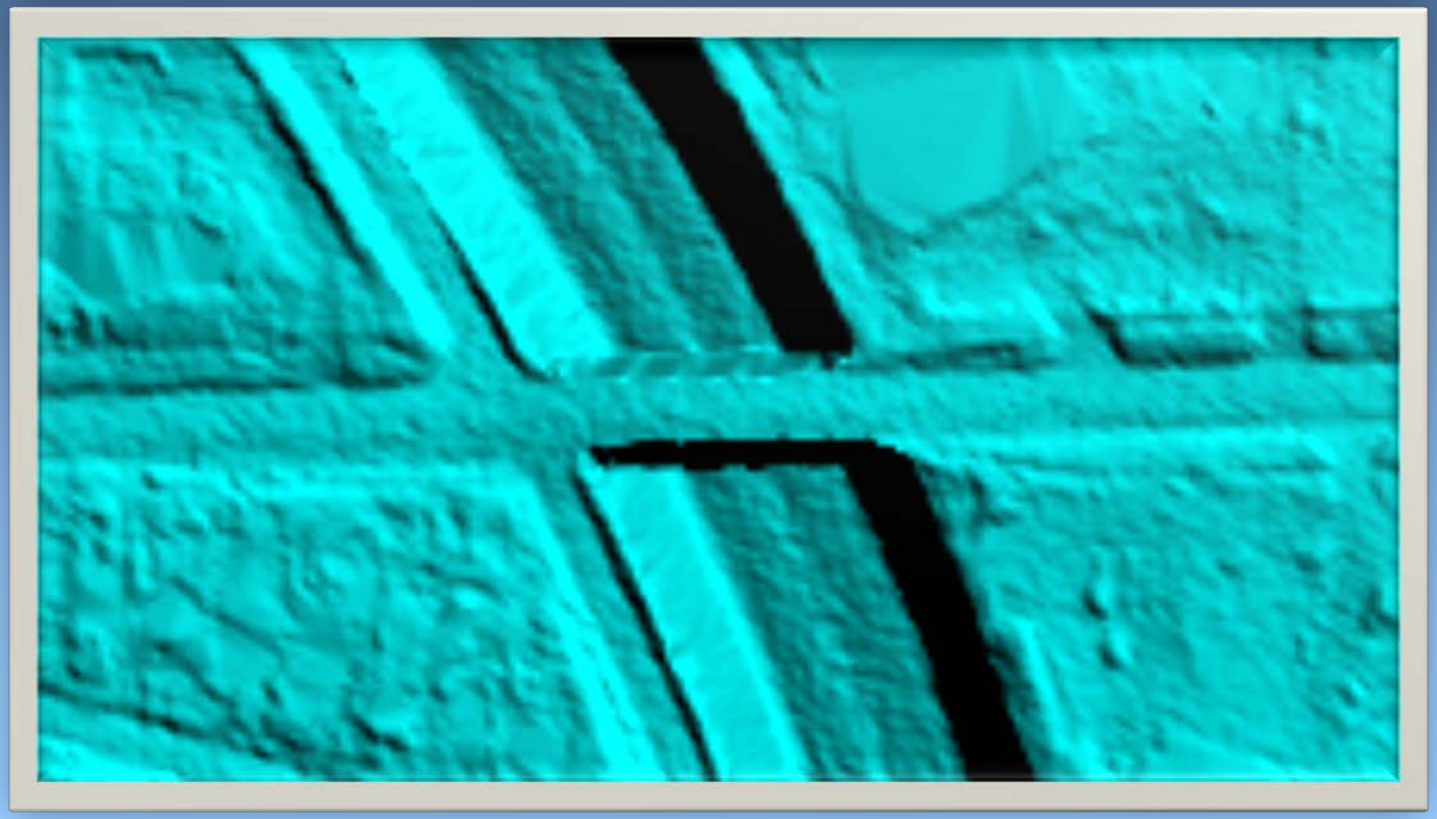
Example Screenshots Lidar QA

DEM Checks – Ditch, Flattening



Example Screenshots Lidar QA

DEM Checks - Bridge



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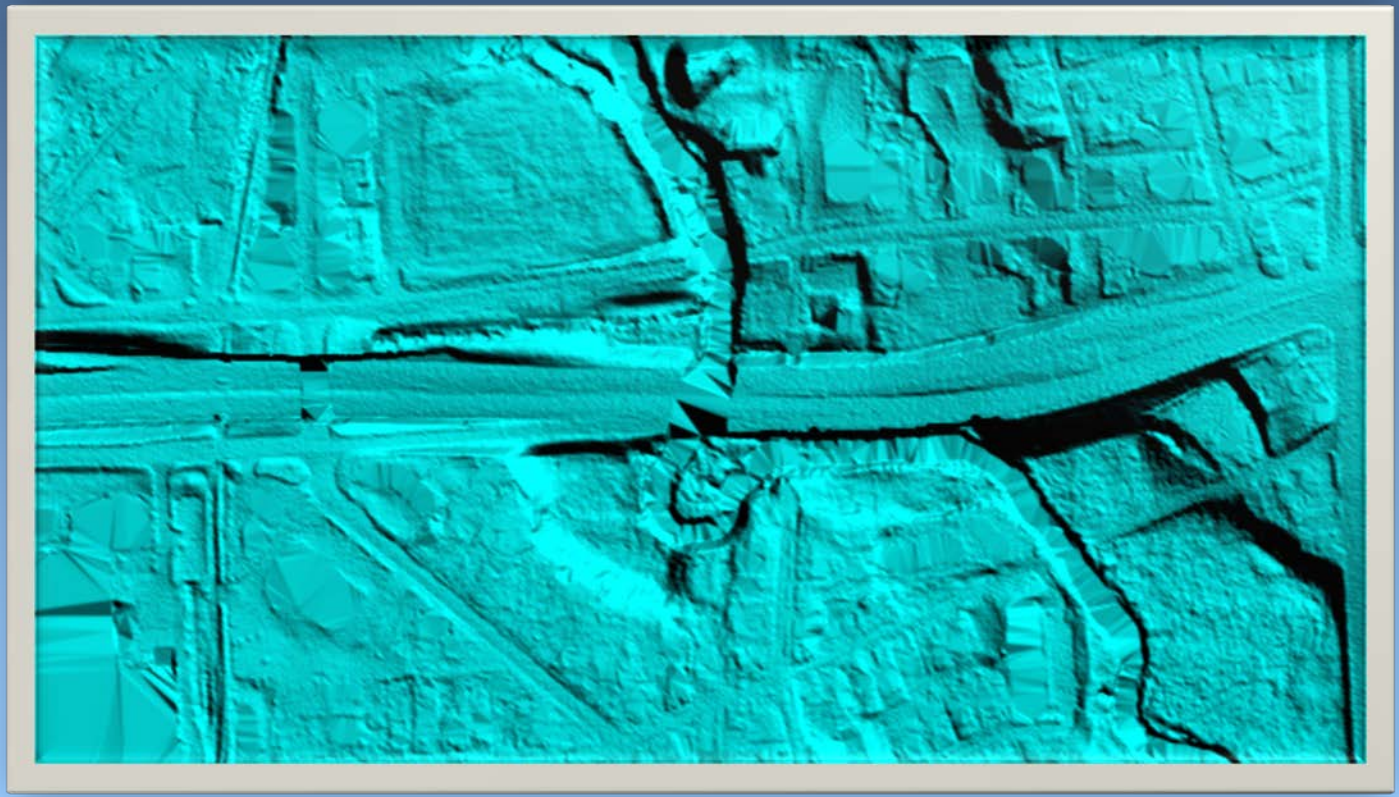

Lidar QA

QA Deliverables

- Contracts or Partners
  - QA Report
- USGS EROS
  - All contractor deliverables
  - DEM mosaic
  - QA report
  - Recommendation for inclusion in NED

Lidar QA

QA Report Evolution

Old

- No LAS checks – other than present
- Assumptions about what is checked
- Entirely QA

New

- Formatting
- Comprehensive
- Additional Checks
- Contract Administrators

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Questions

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