



LiDAR Quality Assessment Report

The USGS National Geospatial Technical Operations Center, Data Operations Branch is responsible for conducting reviews of all Light Detection and Ranging (LiDAR) point-cloud data and derived products delivered by a data supplier before it is approved for inclusion in the National Elevation Dataset and the Center for LiDAR Information Coordination and Knowledge. The USGS recognizes the complexity of LiDAR collection and processing performed by the data suppliers and has developed this Quality Assessment (QA) procedure to accommodate USGS collection and processing specifications with flexibility. The goal of this process is to assure LiDAR data are of sufficient quality for database population and scientific analysis. Concerns regarding the assessment of these data should be directed to the Chief, Data Operations Branch, 1400 Independence Road, Rolla, Missouri 65401 or NGTOCooperations@usgs.gov.

Materials Received:

4/22/2013

Project Type: Partnership

Project ID:

SC_AikenCo_2012_Apr2013

Project Description:

Six County SC Lidar, Aiken County

Project Alias(es):

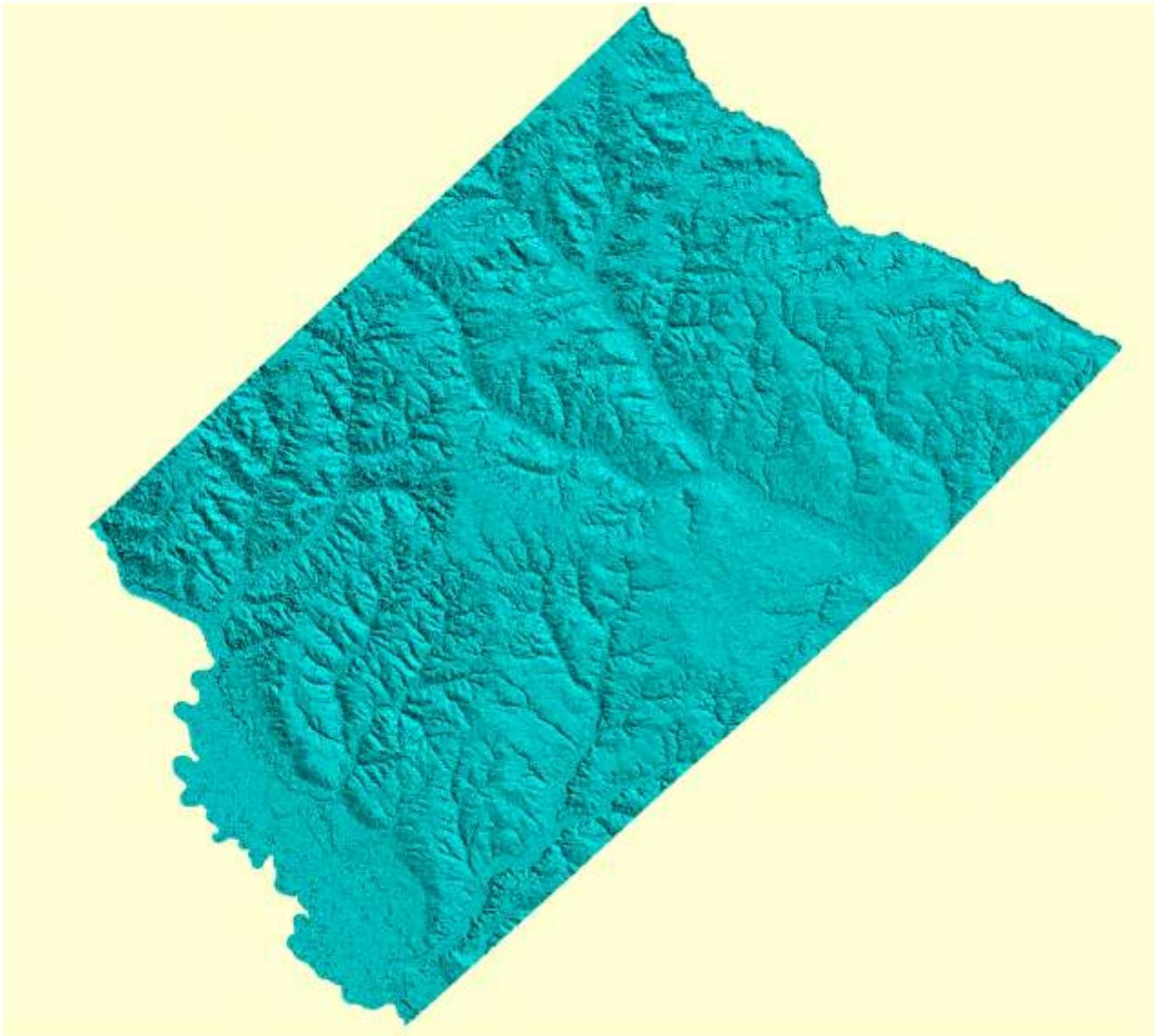
Aiken County Final Review, USGS Contr...

Year of Collection: 2012

Lot 1 of 1 lots.

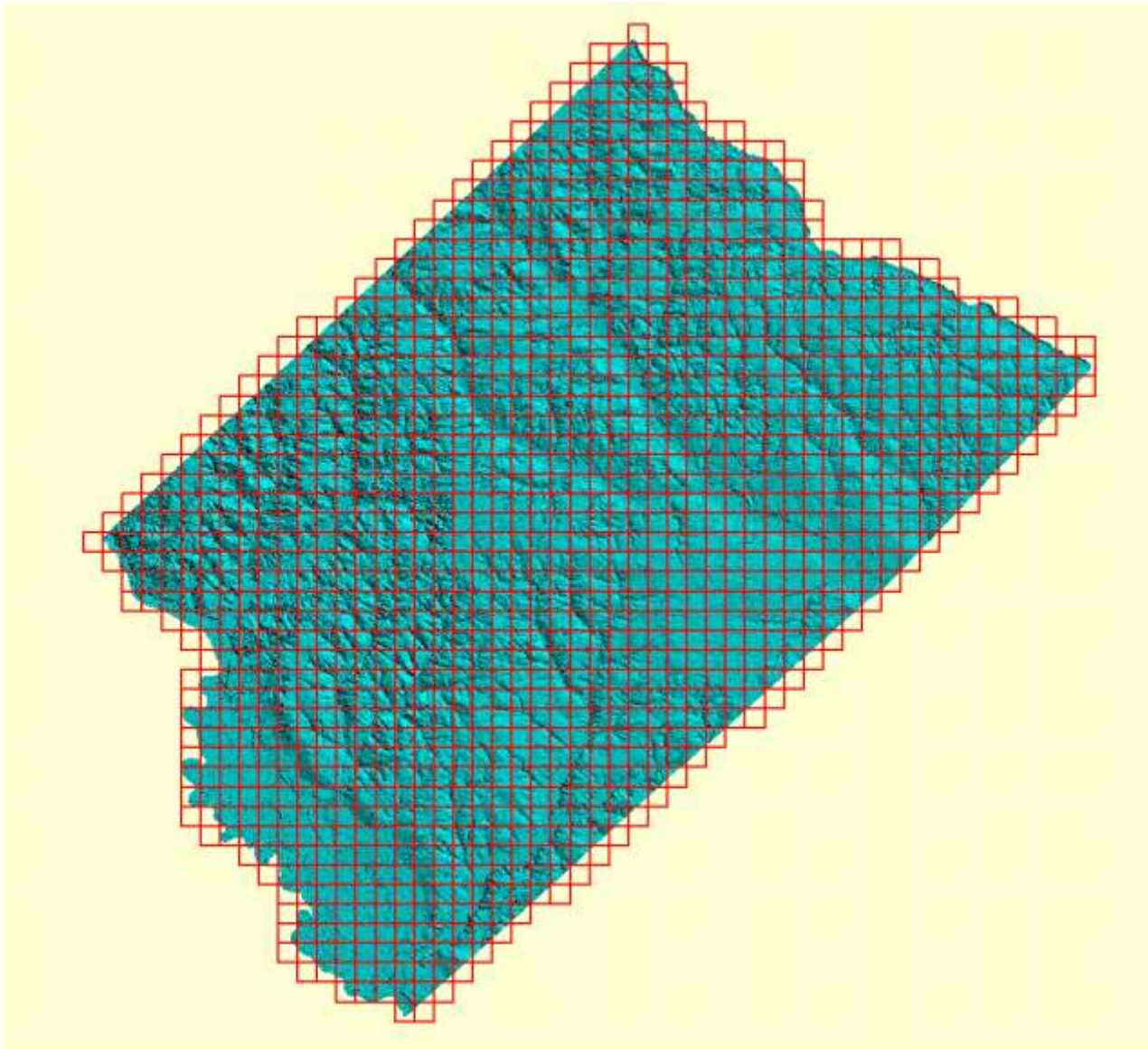
Project Extent:

Project Extent image?



Project Tiling Scheme:

Project Tiling Scheme image?



Contractor:

Dewberry

Applicable Specification:

V12

Licensing Restrictions:

Third Party Performed QA?

Third Party QA Performed By:

Aerometric, 4020 Technology Parkway, Sheboygan, WI 53083-6049

Project Points of Contact:

--	--	--	--

POC Name	Type	Primary Phone	E-Mail
Gary Merrill	NSDI Liaison	803-750-6124	glmerrill@usgs.gov

Project Deliverables

All project deliverables must be supplied according to collection and processing specifications. The USGS will postpone the QA process when any of the required deliverables are missing. When deliverables are missing, the Contracting Officer Technical Representative (COTR) will be contacted by the Elevation/Orthoimagery Section supervisor and informed of the problem. Processing will resume after the COTR has coordinated the deposition of remaining deliverables.

- | | |
|---|---|
| <input checked="" type="checkbox"/> Collection Report | <input checked="" type="checkbox"/> Project Shapefile/Geodatabase |
| <input checked="" type="checkbox"/> Survey Report | <input checked="" type="checkbox"/> Project Tiling Scheme Shapefile/Gdb |
| <input checked="" type="checkbox"/> Processing Report | <input type="checkbox"/> Control Point Shapefile/Gdb |
| <input checked="" type="checkbox"/> QA/QC Report | <input checked="" type="checkbox"/> Breakline Shapefile/Gdb |
| <input type="checkbox"/> Control and Calibration Points | <input checked="" type="checkbox"/> Project XML Metadata |

Multi-File Deliverables

File Type	Quantity
<input type="checkbox"/> Swath LAS Files <input type="checkbox"/> Required? <input type="checkbox"/> XML Metadata?	1
<input checked="" type="checkbox"/> Intensity Image Files <input checked="" type="checkbox"/> Required?	1343
<input checked="" type="checkbox"/> Tiled LAS Files <input checked="" type="checkbox"/> Required? <input checked="" type="checkbox"/> XML Metadata?	1343
<input checked="" type="checkbox"/> Breakline Files <input checked="" type="checkbox"/> Required? <input checked="" type="checkbox"/> XML Metadata?	5
<input checked="" type="checkbox"/> Bare-Earth DEM Files <input checked="" type="checkbox"/> Required? <input checked="" type="checkbox"/> XML Metadata?	1

Additional Deliverables

Item
<input checked="" type="checkbox"/>

Errors, Anomalies, Other Issues to document? Yes No

None.

Project Geographic Information

Areal Extent:

1112

Sq Mi

Grid Size:

--

5000

Int'l Feet
Tile Size:

5000

int'l feet
Nominal Pulse Spacing:

1.4

meters

Vertical Datum: NAVD88 U.S. feet

Horizontal Datum: NAD83 int'l feet

Project Projection/Coordinate Reference System:
3900 South Carolina State Plane Coordinate System U.S. feet.

This Projection Coordinate Reference System is consistent across the following deliverables:

- Project Shapefile/Geodatabase
- Breaklines XML Metadata File
- Project Tiling Scheme Shapefile/Gdb
- Bare-Earth DEM XML Metadata File
- Checkpoints Shapefile/Geodatabase
- Swath LAS Files
- Project XML Metadata File
- Classified LAS Files
- Swath LAS XML Metadata File
- Breaklines Files
- Classified LAS XML Metadata File
- Bare-Earth DEM Files

Check Point Shapefile/Geodatabase CRS

None Provided

Swath LAS XML Metadata CRS

None Provided

Swath LAS Files CRS

None Provided

None Provided

Review Cycle

This section documents who performed the QA Review on a project as well as when QA reviews were started, actions passed, received, and completed.

Reviewer:

JD Cox

Review Start Date:

5/29/2013

Action to Contractor Date	Issue Description	Return Date
	See Report	8/6/2014
	See Report	

Review Complete:

Metadata Review

Provided metadata files have been parsed using 'mp' metadata parser. Any errors generated by the parser are documented below for reference and/or corrective action.

The Project XML Metadata file parsed without errors.

The Classified LAS XML Metadata file parsed without errors.

The Breakline XML Metadata file parsed without errors.

The Bare-Earth DEM XML Metadata file parsed without errors.

Project QA/QC Report Review

ASPRS recommends that checkpoint surveys be used to verify the vertical accuracy of LiDAR data sets. Checkpoints are to be collected by an independent survey firm licensed in the particular state(s) where the project is located. While subjective, checkpoints should be well distributed throughout the dataset. National Standards for Spatial Data Accuracy (NSSDA) guidance states that checkpoints may be distributed more densely in the vicinity of important features and more sparsely in areas that are of little or no interest. Checkpoints should be distributed so that points are spaced at intervals of at least ten percent of the diagonal distance across the dataset and at least twenty percent of the points are located in each quadrant of the dataset.

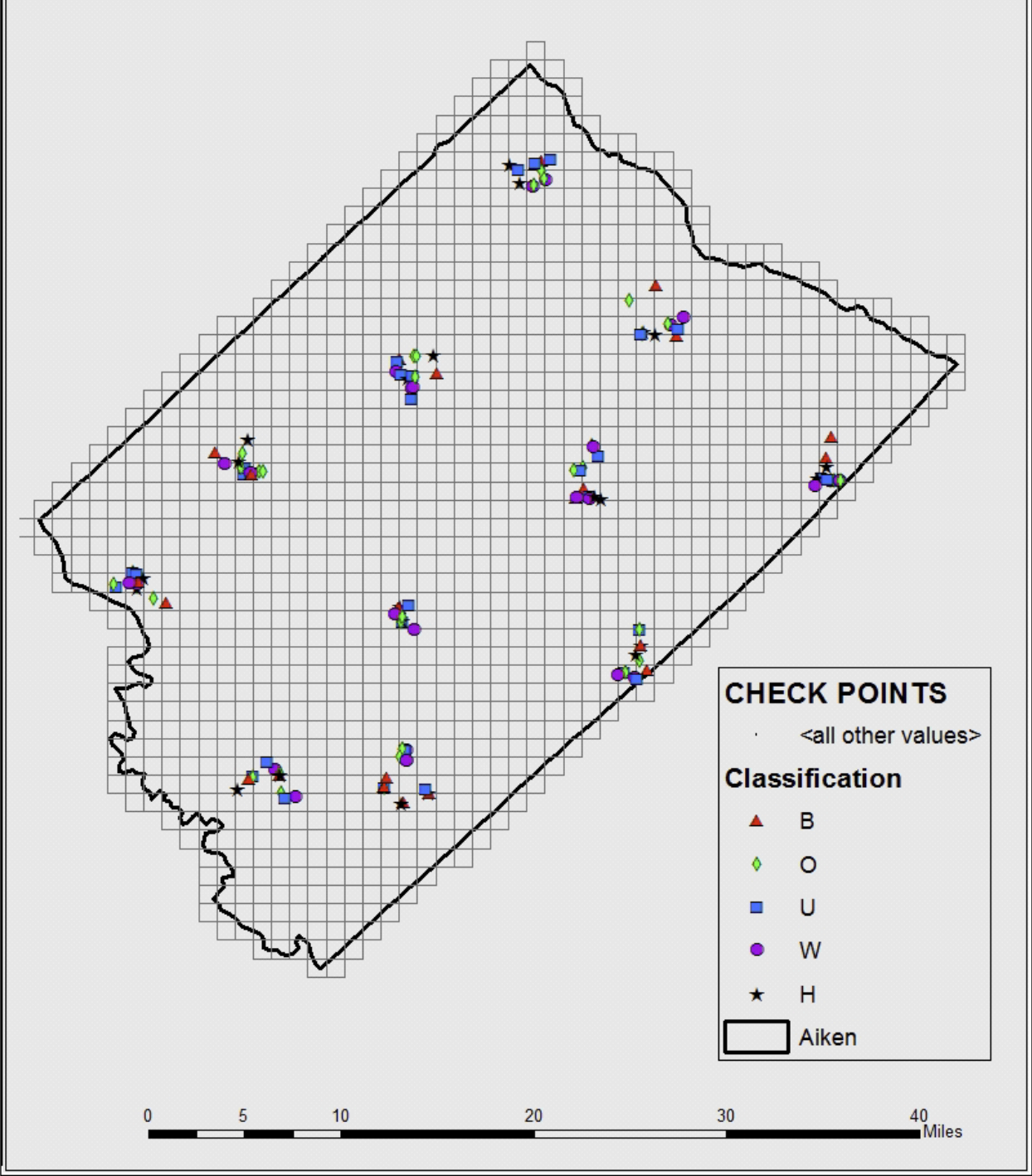
NSSDA and ASPRS require that a minimum of twenty checkpoints (thirty is preferred) are collected for each major land cover category represented in the LiDAR data. Checkpoints should be selected on flat terrain, or on uniformly sloping terrain in all directions from each checkpoint. They should not be selected near severe breaks in slope, such as bridge abutments, edges of roads, or near river bluffs. Checkpoints are an important component of the USGS QA process. There is the presumption that the checkpoint surveys are error free and the discrepancies are attributable to the LiDAR dataset supplied.

For this dataset, USGS checked the spatial distribution of checkpoints with an emphasis on the bare-earth (open terrain) points; the number of points per class; the methodology used to collect these points; and the relationship between the data supplier and checkpoint collector. When independent control data are available, USGS has incorporated this into the analysis.

Checkpoint Shapefile or Geodatabase:

Checkpoint Distribution Image?

Aiken County Checkpoints



The following land cover classes are represented in this dataset (uncheck any that do not apply):

- Bare Earth
- Tall Weeds and Crops
- Brush Lands and Low Trees
- Forested Areas Fully Covered by Trees
- Urban Areas with Dense Man-Made Structures

There are a minimum of 20 checkpoints for each land cover class represented. Points within each class are uniformly distributed throughout the dataset. USGS was not able to locate independent checkpoints for this analysis. USGS does not accept at this time the quality of the checkpoint data for these LiDAR datasets.

Errors, Anomalies, Other Issues to document? Yes No

Image?

No Checkpoint Shapefile or Geodatabase was provided. An independent check of vertical accuracy was not possible. Figures in this section are from the Third Party QA Report.

The Task Order stated there should be a minimum of 20 checkpoints for each of the 5 classes for each county. There are 143 total checkpoints for this county. The Bare Earth classification had 36 points. The other classes have from 23 to 34 points.

Accuracy values are reported in terms of Fundamental Vertical Accuracy (FVA), Supplemental Vertical Accuracy(s) (SVA), and Consolidated Vertical Accuracy (CVA).

Accuracy values are reported in:

Required FVA Value is or less.
 Target SVA Value is or less.
 Required CVA Value is or less.

The reported FVA of the LAS Swath data is .

The reported FVA of the Bare-Earth DEM data is .

SVA are required for each land cover type present in the data set with the exception of

bare-earth. SVA is calculated and reported as a 95th Percentile Error.

Land Cover Type	SVA Value	Units
Tall Weeds and Crops	0.703	U.S. feet
Brush Lands and Low Trees	0.556	U.S. feet
Forested Areas Fully Covered by Trees	0.681	U.S. feet
Urban Areas with Dense Man-Made Structu...	0.375	U.S. feet

The reported CVA of this data set is: 0.664 U.S. feet.

LAS Tile File Review

Classified LAS tile files are used to build digital terrain models using the points classified as ground. Therefore, it is important that the classified LAS are of sufficient quality to ensure that the derivative product accurately represents the landscape that was measured. The following was determined for classified LAS files for this project:

Classified LAS Tile File Characteristics

- Separate folder for Classified LAS tile files
- Classified LAS tile files conform to Project Tiling Scheme
- Quantity of Classified LAS tile files conforms to Project Tiling Scheme
- Classified LAS tile files do not overlap
- Classified LAS tile files are uniform in size
- Classified LAS tile files have no points classified as '12'

Point classifications are limited to the standard values listed below:

Code	Description
1	Processed, but unclassified
2	Bare-earth ground
7	Noise (low or high, manually identified, if needed)
9	Water
10	Ignored ground (breakline proximity)
11	Withheld (if the "Withheld" bit is not implemented in processing software)

Buy up?

Additional classifications in this data set.

- 3 - Tall weeds and crops (low vegetation)
- 4 - Brush lands and low trees (medium vegetation)
- 5 - Forested areas fully covered by trees
- 6 - Urban area with dense man-made structures

8 - Model Key Points

13 Points removed from Bridges

Based on this review, the USGS does not accept at this time the classified LAS tile file data.

Errors, Anomalies, Other Issues to document? Yes No

Image?

Header file not populated correctly-unknown coordinate system listed.

Acceptance Criteria states scan angles of +/- 18 degrees. Point Cloud Statistics list scan angles as high as 35 degrees.

No Tiled LAS Data (Classified LAS DATA) was provided with the 8/6/2014 corrected data. Some of the DEM Review corrections noted would require changes to the Classified LAS Data. Without new corrected Classified LAS Data this project can never be accepted into the NED.

Breakline File Review

Breaklines are vector feature classes that are used to hydro-flatten the bare earth Digital Elevation Models.

Breakline File Characteristics

- Separate folder for breakline files
- All breaklines captured as PolylineZ or PolygonZ features
- No missing or misplaced breaklines

Based on this review, the USGS does not accept at this time the breakline files.

Errors, Anomalies, Other Issues to document? Yes No

Image for error?

Some streams appeared to have missing breaklines

More streams may be required to meet coverage of 1/2 acre or larger drainage area criteria.

Many of the smaller stream disconnects were connected. Some streams, with much larger gaps, still appeared to need to be connected. These streams stopped without appearing to flow into another lake, river, or stream. If this is correct, there should be mention of losing streams in the reports and the metadata.

Bare-Earth DEM Tile File Review

The derived bare-earth DEM file receives a review of the vertical accuracies provided by the data supplier, vertical accuracies calculated by USGS using supplied and independent checkpoints, and a manual check of the appearance of the DEM layer.

Bare-Earth DEM files provided in the following format:

Bare-Earth DEM Tile File Characteristics

- Separate folder for bare-earth DEM files
- DEM files conform to Project Tiling Scheme
- Quantity of DEM files conforms to Project Tiling Scheme
- DEM files do not overlap
- DEM files are uniform in size
- DEM files properly edge match
- Independent check points are well distributed

All accuracy values reported in .

Reported Accuracies

Land Cover Category	# of Points	Fundamental Vertical Accuracy @95% Confidence Interval (Accuracy _z) Required FVA = <input type="text" value="1.19"/> or less.	Supplemental Vertical Accuracy @95th Percentile Error Target SVA = <input type="text" value="1.19"/> or less.	Consolidated Vertical Accuracy @95th Percentile Error Required CVA = <input type="text" value="1.19"/> or less.
Open Terrain	<input type="text" value="36"/>	<input type="text" value="0.595"/>		
Tall Weeds and Crops	<input type="text" value="23"/>		<input type="text" value="0.703"/>	
Brush Lands and Low Trees	<input type="text" value="24"/>		<input type="text" value="0.556"/>	
Forested Areas Fully Covered by Trees	<input type="text" value="26"/>		<input type="text" value="0.681"/>	
Urban Areas with Dense Man-Made Structures	<input type="text" value="34"/>		<input type="text" value="0.375"/>	
Consolidated	<input type="text" value="143"/>			<input type="text" value="0.664"/>

QA performed Accuracy Calculations?

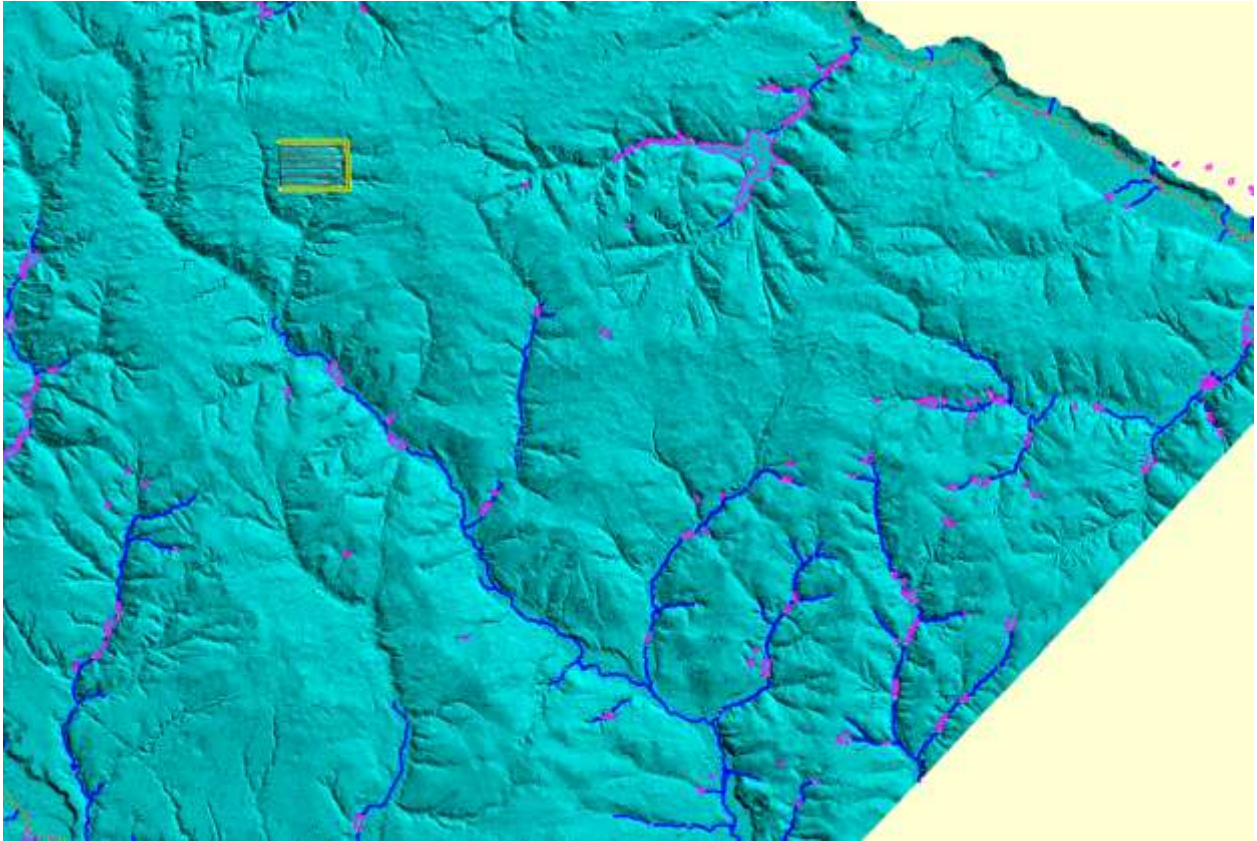
Based on this review, the USGS does not recommend the bare-earth DEM files for inclusion in the 1/3 Arc-Second National Elevation Dataset.

Based on this review, the USGS does not accept at this time the bare-earth DEM files.

Bare-Earth DEM Anomalies, Errors, Other Issues

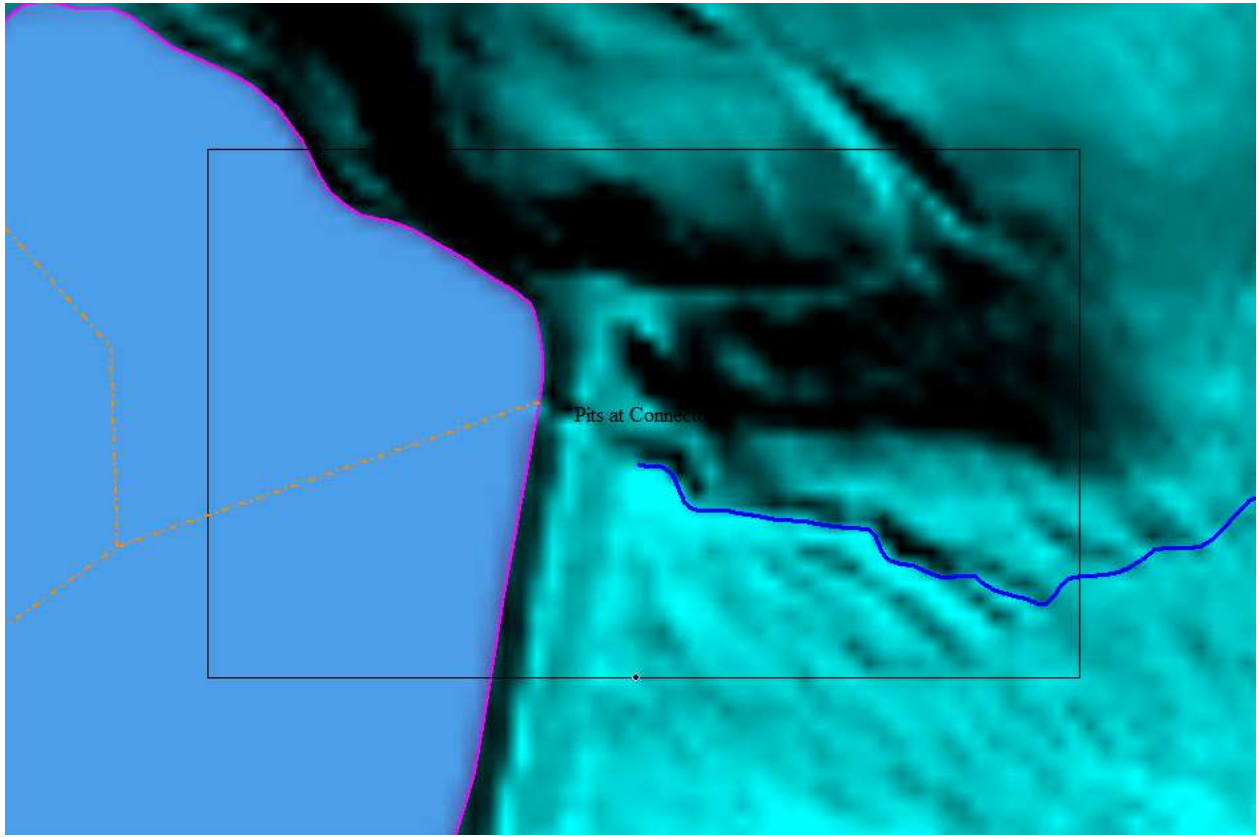
Errors, Anomalies, Other Issues to document? Yes No

Image?



The box represents a 1/2 sq mile, Blue lines are hydro breaklines. Per the Task Order, Hydro Breakline Specifications, Hydro feature data capture requirements; "Hydro breaklines will be captured for drainage features that drain approximately 1/2 sq mile or more." The shortage of these breaklines seems typical in many areas of the county.

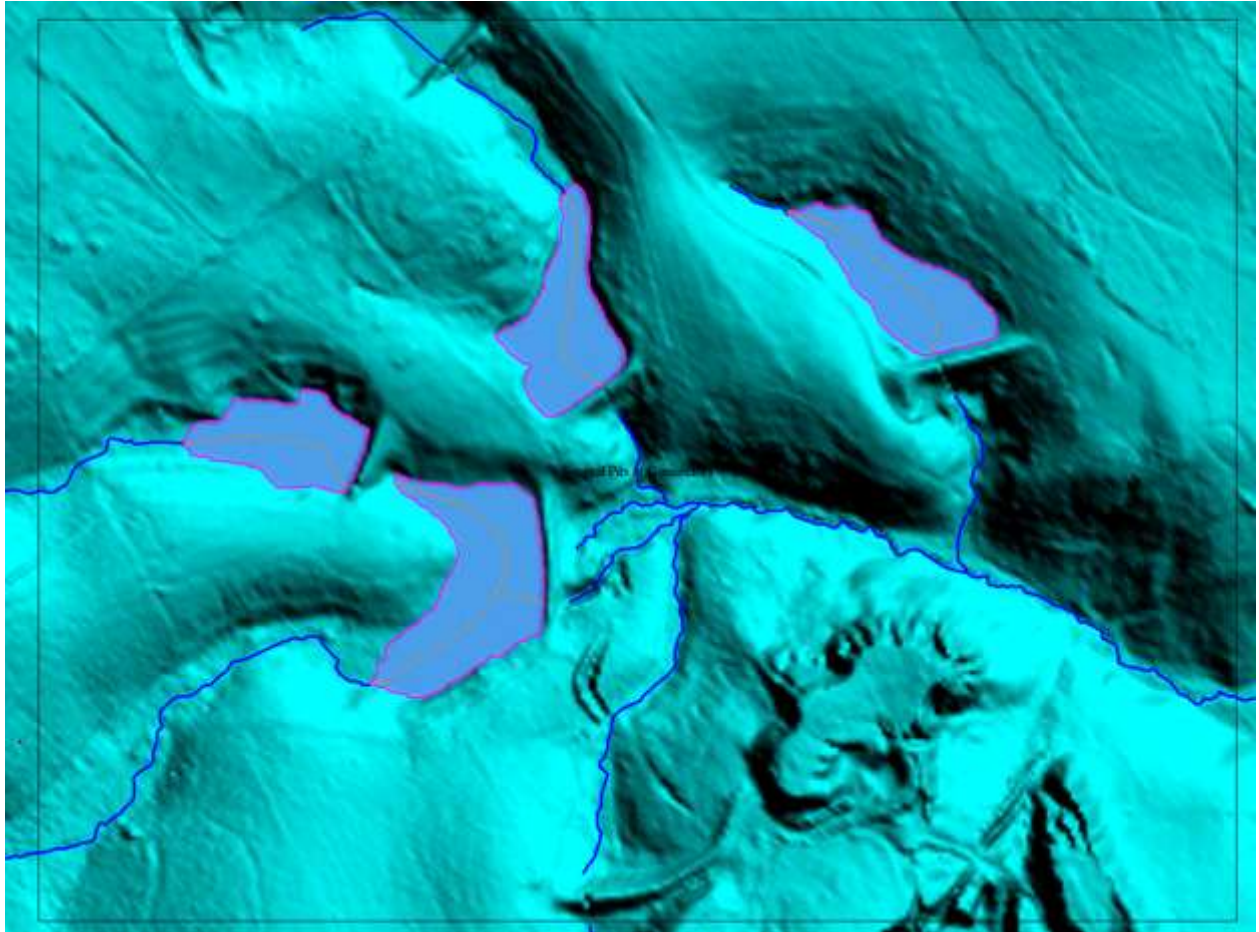
Image?



Typical Pits at Connector

These Pits are still prevalent in the 8/6/2014 data.

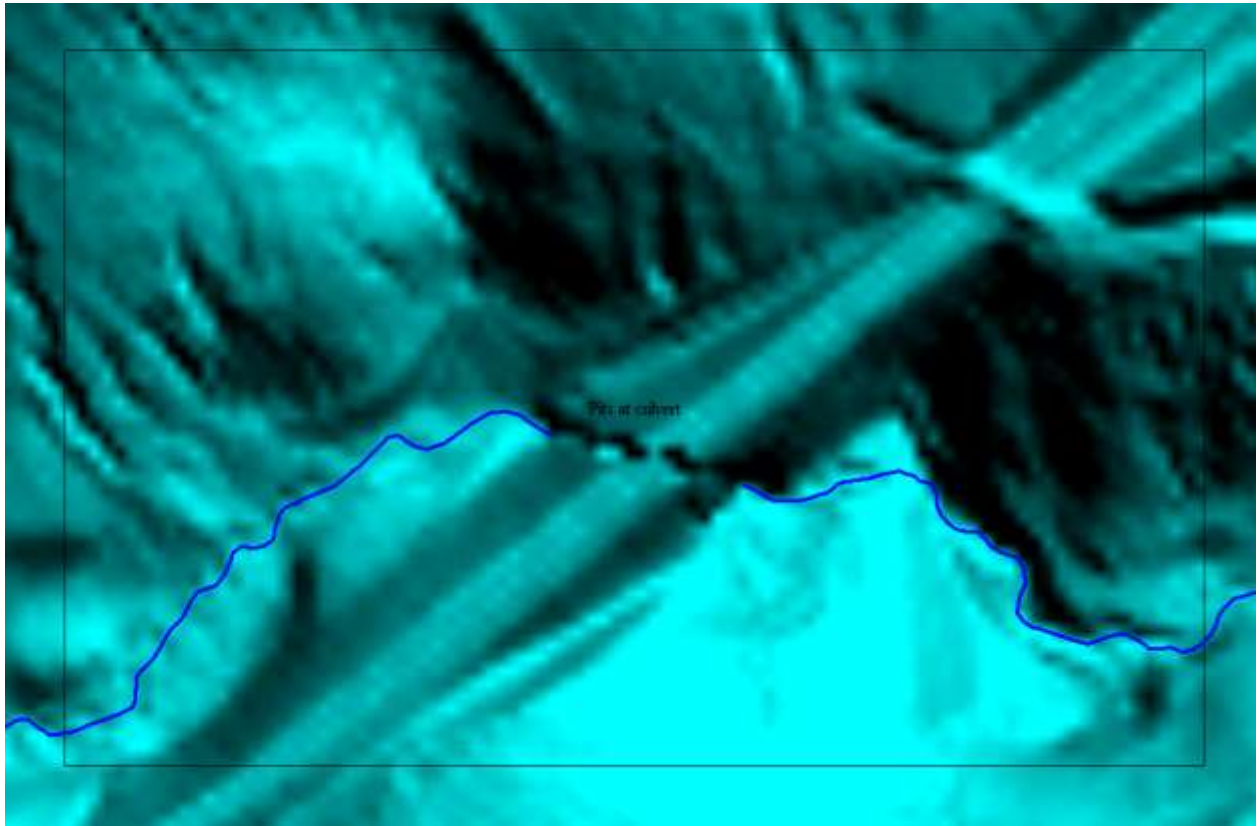
Image?



Several Pits at Connectors

These Pits are still prevalent in the 8/6/2014 data.

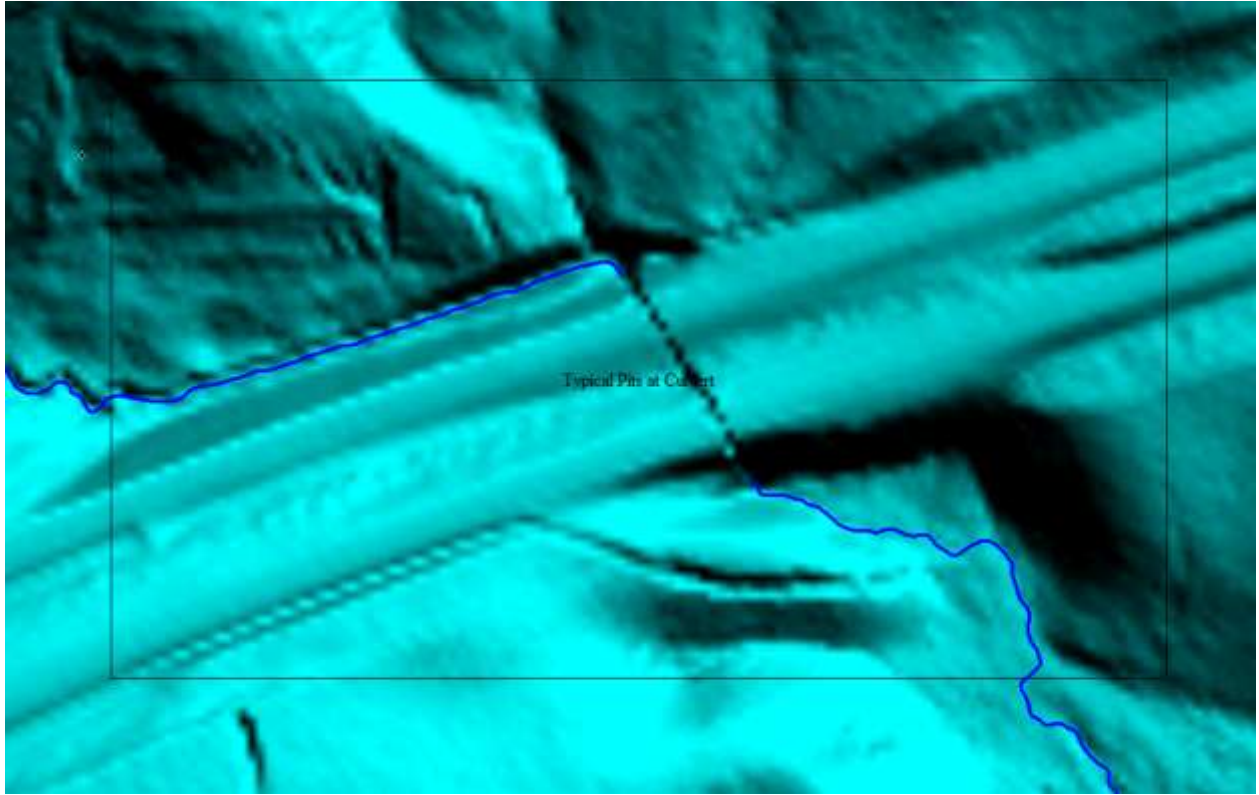
Image?



Typical Pits at Culvert

These Pits are still prevalent in the 8/6/2014 data.

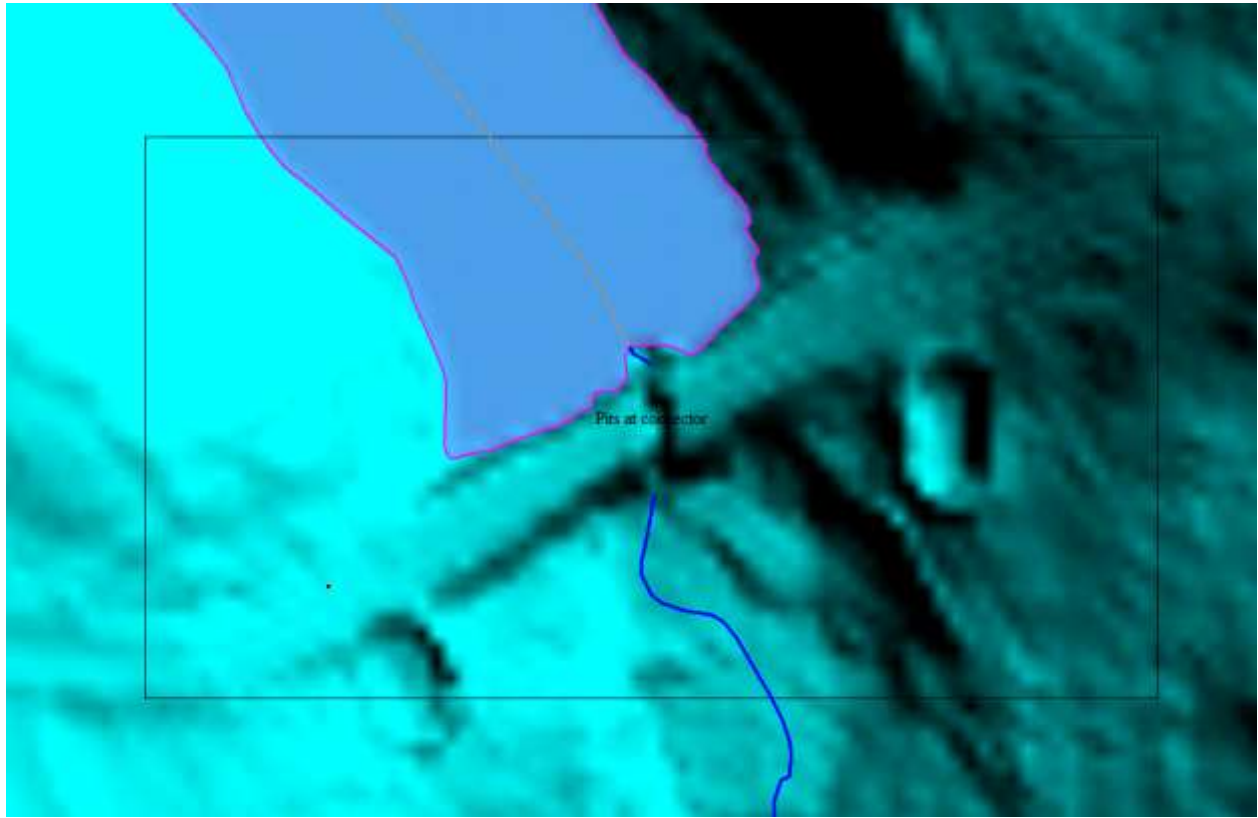
Image?



Typical Pits at Culvert

These Pits are still prevalent in the 8/6/2014 data.

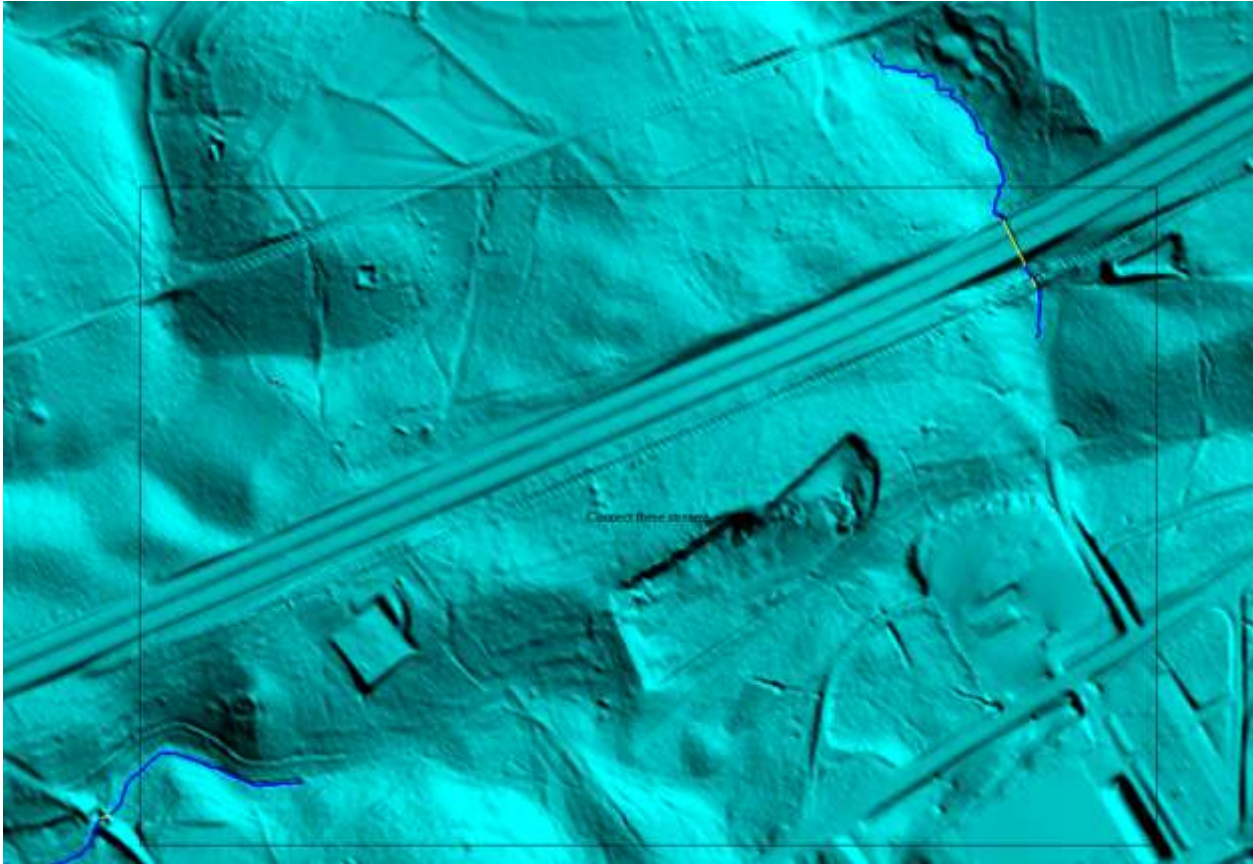
Image?



Typical Pits at connector

These Pits are still prevalent in the 8/6/2014 data.

Image?



Connect these streams? Many of the smaller stream disconnects were connected. Some streams, with much larger gaps, still appeared to need to be connected. These streams stopped without appearing to flow into another lake, river, or stream. If this is correct, there should be mention of losing streams in the reports and the metadata.

Internal Note:

This is the end of the report.

QA Form V1.4 12OCT11.xsn

