



# 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:

10/26/2012

Project Type: Partnership

Project ID:

SC\_LexingtonCo\_2010

Project Description:

Lexington County, South Carolina,  
Collection Dates: 03/14/2010 -  
03/27/2010

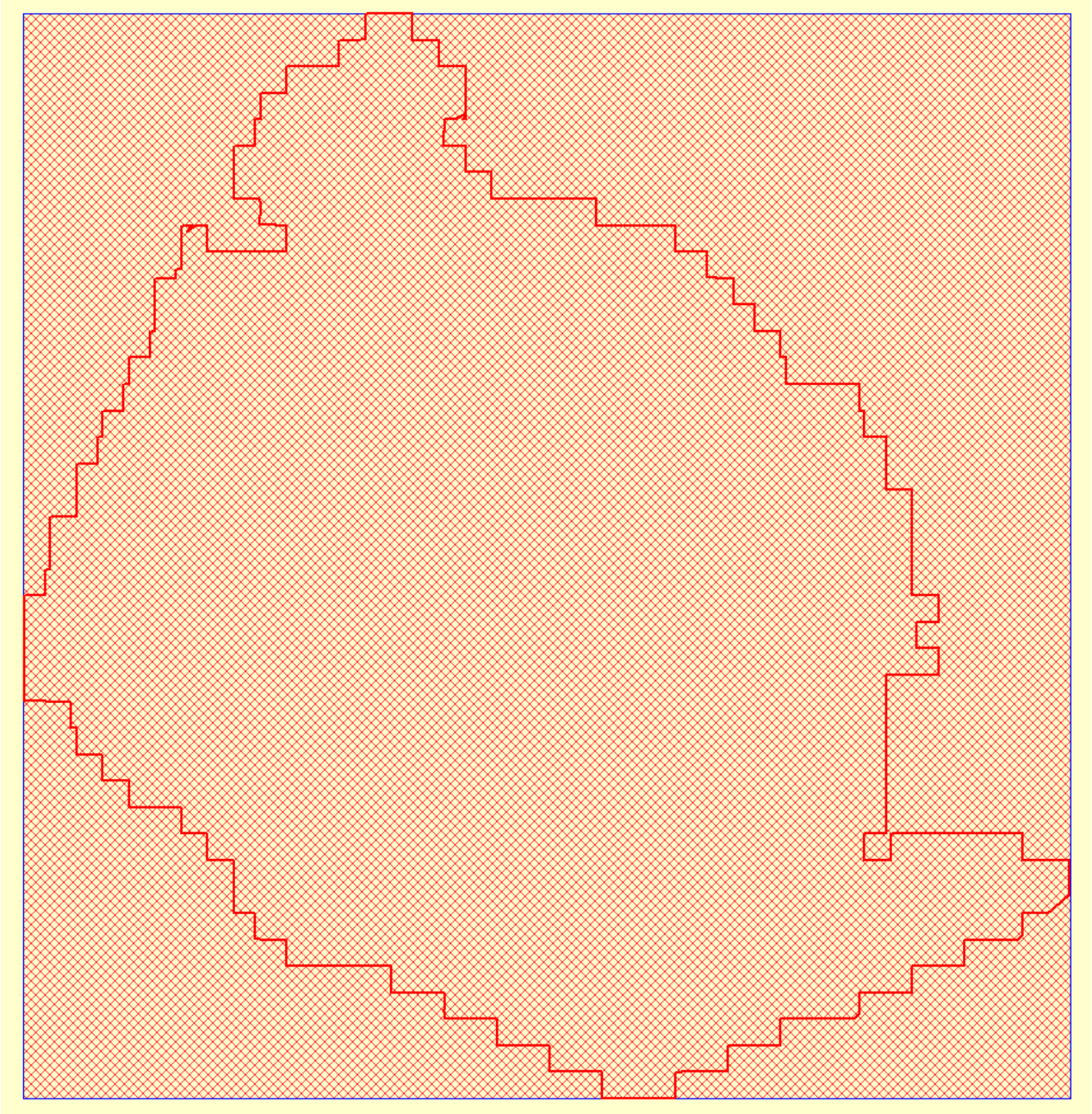
Project Alias(es):

Year of Collection: 2010

Lot 1 of 1 lots.

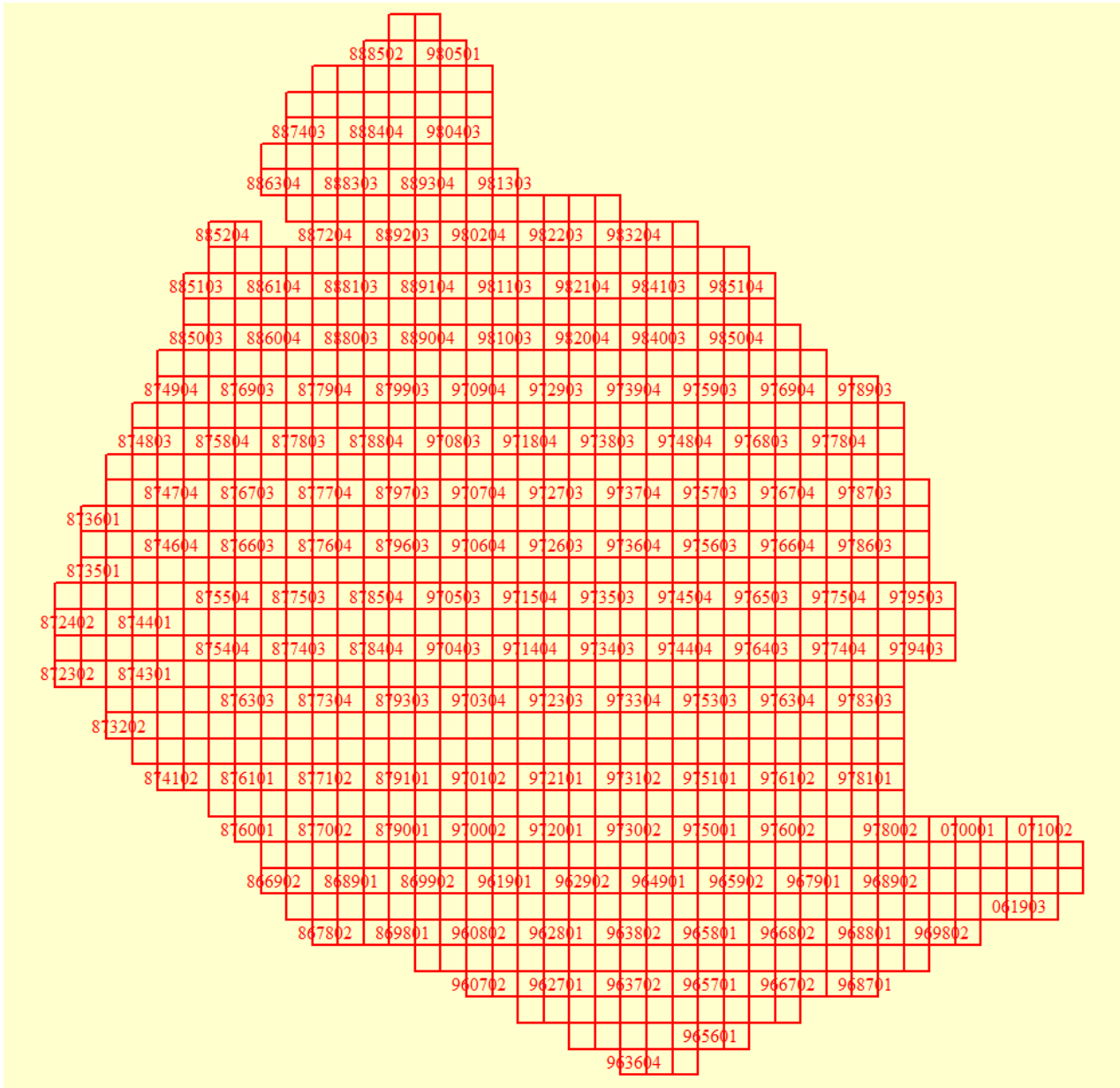
Project Extent:

Project Extent image?



Project Tiling Scheme:

Project Tiling Scheme image?



Contractor:

Sanborn

Applicable Specification:

V13

Licensing Restrictions:

[Empty text box for Licensing Restrictions]

Third Party Performed QA?

Third Party QA Performed By:

Dewberry

Project Points of Contact:

<b>POC Name</b>	<b>Type</b>	<b>Primary Phone</b>	<b>E-Mail</b>
Gary Merrill	USGS Geospatial Li...	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 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 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?	940
<input checked="" type="checkbox"/> Tiled LAS Files <input type="checkbox"/> Required? <input checked="" type="checkbox"/> XML Metadata?	940
<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

Errors, Anomalies, Other Issues to document?  Yes  No

None.

# Project Geographic Information

Areal Extent:

828.75

Sq Mi

Grid Size:

10

Int'l Feet

Tile Size:

20495x19902

int'l feet

Nominal Pulse Spacing:

1.4

meters

Vertical Datum: NAVD88 U.S. feet

Horizontal Datum: NAD83\_HARN int'l feet

Project Projection/Coordinate Reference System:

NAD\_1983\_HARN\_StatePlane\_South\_Carolina\_FIPS\_3900 international feet.

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

- |   |  |
|---|--|
| <input checked="" type="checkbox"/> Project Shapefile/Geodatabase       | <input checked="" type="checkbox"/> Breaklines XML Metadata File     |
| <input checked="" type="checkbox"/> Project Tiling Scheme Shapefile/Gdb | <input checked="" type="checkbox"/> Bare-Earth DEM XML Metadata File |
| <input type="checkbox"/> Checkpoints Shapefile/Geodatabase              | <input type="checkbox"/> Swath LAS Files                             |
| <input type="checkbox"/> Project XML Metadata File                      | <input checked="" type="checkbox"/> Classified LAS Files             |
| <input type="checkbox"/> Swath LAS XML Metadata File                    | <input type="checkbox"/> Breaklines Files                            |
| <input checked="" type="checkbox"/> Classified LAS XML Metadata File    | <input checked="" type="checkbox"/> Bare-Earth DEM Files             |

Check Point Shapefile/Geodatabase CRS

None Provided

Project XML Metadata CRS

None Provided

Swath LAS XML Metadata CRS

None Provided

Swath LAS Files CRS

None Provided

Breakline Files CRS

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:

Select or type...

Review Start Date:

12/6/2012

Action to Contractor Date	Issue Description	Return Date
1/14/2013		8/1/2013

Review Complete: 9/25/2013

## 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 witherrors.

None provided.

The Classified LAS XML Metadata file parsed withouterrors.

The Breakline XML Metadata file parsed withouterrors.

The Bare-Earth DEM XML Metadata file parsed withouterrors.





# Project QA/QC Report Review

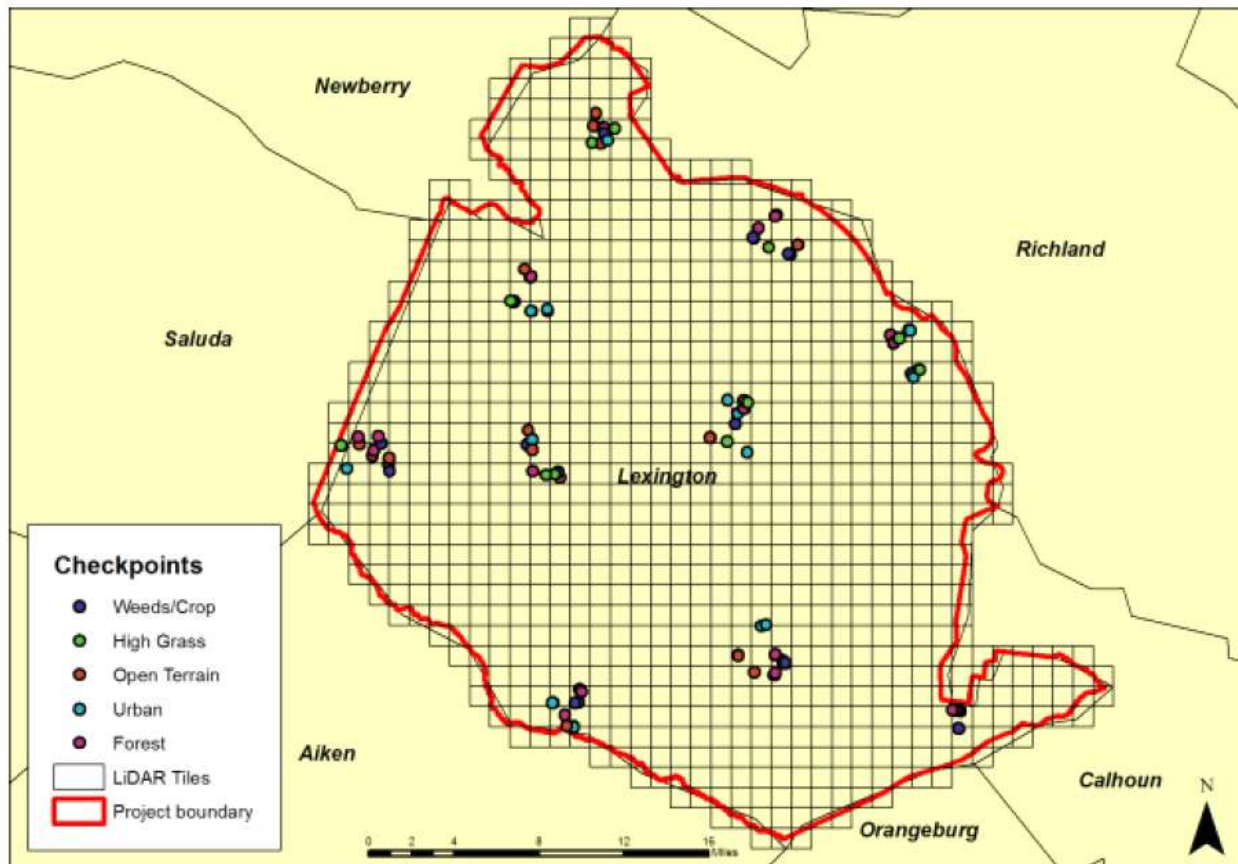
ASPRS recommends that checkpoint surveys be used to verify the vertical accuracy of LiDAR data sets. Checkpoints are to be collected by an independent survey firm licensed in the particular state(s) where the project is located. While subjective, checkpoints should be well distributed throughout the 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?



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 able to locate independent checkpoints for this analysis. USGS accepts the quality of the checkpoint data for these LiDAR datasets.

Errors, Anomalies, Other Issues to document?  Yes  No

None.

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  U.S. feet or less.

Target SVA Value is  U.S. feet or less.

Required CVA Value is  U.S. feet or less.

The reported FVA of the LAS Swath data is .

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

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	<input type="text" value="0.65"/>	<input type="text" value="U.S. feet"/>
Brush Lands and Low Trees	<input type="text" value="0.76"/>	<input type="text" value="U.S. feet"/>
Forested Areas Fully Covered by Trees	<input type="text" value="1.06"/>	<input type="text" value="U.S. feet"/>
Urban Areas with Dense Man-Made Structu...	<input type="text" value="0.73"/>	<input type="text" value="U.S. feet"/>

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

## 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 accepts the breakline files.

Yes  No

## 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 <sub>z</sub> ) Required FVA = 0.96 or less.	Supplemental Vertical Accuracy @95th Percentile Error Target SVA = 1.19 or less.	Consolidated Vertical Accuracy @95th Percentile Error Required CVA = 1.19 or less.
Open Terrain	<input type="text" value="43"/>	<input type="text" value="0.88"/>		
Tall Weeds and Crops	<input type="text" value="20"/>		<input type="text" value="0.65"/>	
Brush Lands and Low Trees	<input type="text" value="24"/>		<input type="text" value="0.76"/>	
Forested Areas Fully Covered by Trees	<input type="text" value="30"/>		<input type="text" value="1.06"/>	
Urban Areas with Dense Man-Made Structures	<input type="text" value="21"/>		<input type="text" value="0.73"/>	
Consolidated	<input type="text" value="138"/>			<input type="text" value="0.82"/>

- QA performed Accuracy Calculations?

### Calculated Accuracies

		Fundamental Vertical Accuracy @95%	Supplemental Vertical Accuracy	Consolidated Vertical Accuracy

Land Cover Category	# of Points	Confidence Interval (Accuracy <sub>z</sub> ) Required FVA = 0.96 or less.	@95th Percentile Error Target SVA = 1.19 or less.	@95th Percentile Error Required CVA = 1.19 or less.
Open Terrain	41	<b>0.99</b>		
Tall Weeds and Crops	21		0.67	
Brush Lands and Low Trees	20		0.66	
Forested Areas Fully Covered by Trees	24		0.90	
Urban Areas with Dense Man-Made Structures	30		0.94	
Consolidated	136			0.87

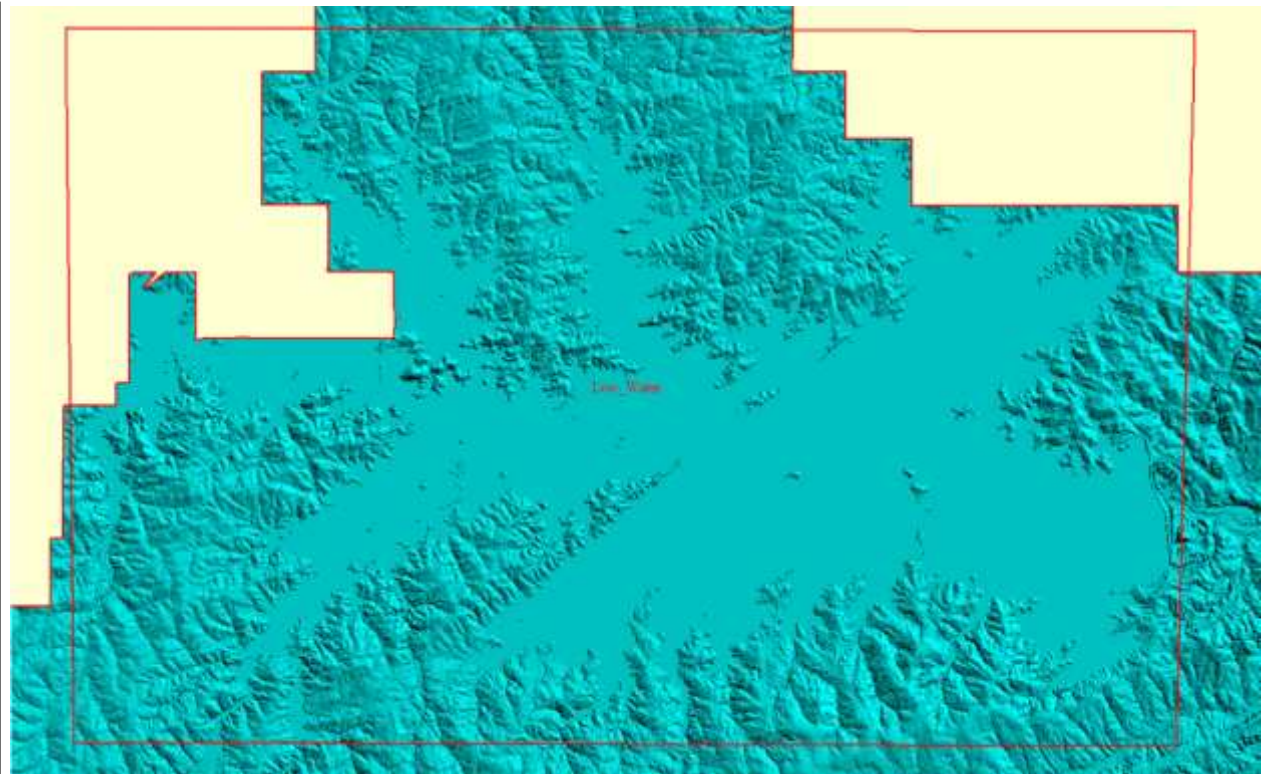
Based on this review, the USGS recommends the bare-earth DEM files for inclusion in the 1/3 Arc-Second National Elevation Dataset.

Based on this review, the USGS accepts the bare-earth DEM files.

Bare-Earth DEM Anomalies, Errors, Other Issues

Errors, Anomalies, Other Issues to document?  Yes  No

Image?



low water at location  $34^{\circ} 04' 35.1474''$  N,  $81^{\circ} 21' 8.9059''$  W

The corrections were received in August 2013. The water level was raised, however there was an error which was corrected with a triangulated patch in the DEM only.

Image?

There were 3 waterbodies that were edited by NGTOC after the second review. The breaklines were edited as well as the DEM.

Image?

The statement of work required an FVA of 0.96 feet which was less than the required FVA reported by the vendor. The NGTOC calculated FVA meets the V13 required value.

Internal Note:

Project level metadata was not provided.

**This is the end of the report.**

QA Form V1.4 12OCT11.xsn