



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:

7/25/2012

Project Type: NSDI Agreement

Project ID:

AK_MatanuskaSusitna-Lot1_2011

Project Description:

Delivery of Point MacKenzie block

Project Alias(es):

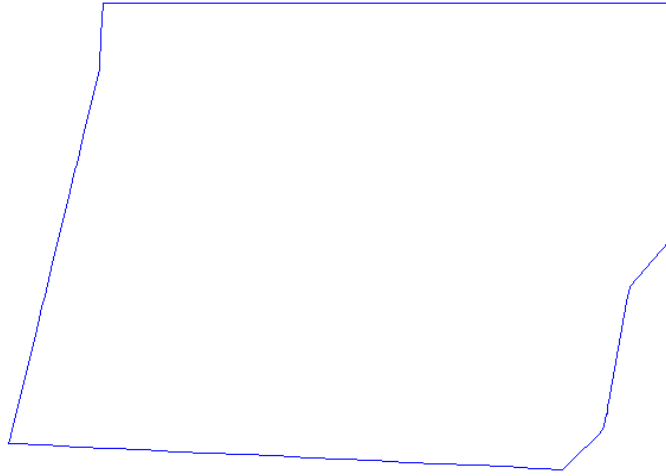
AK_Mat-Su_2011, Point MacKenzie Block

Year of Collection: 2011

Lot 1 of 2 lots.

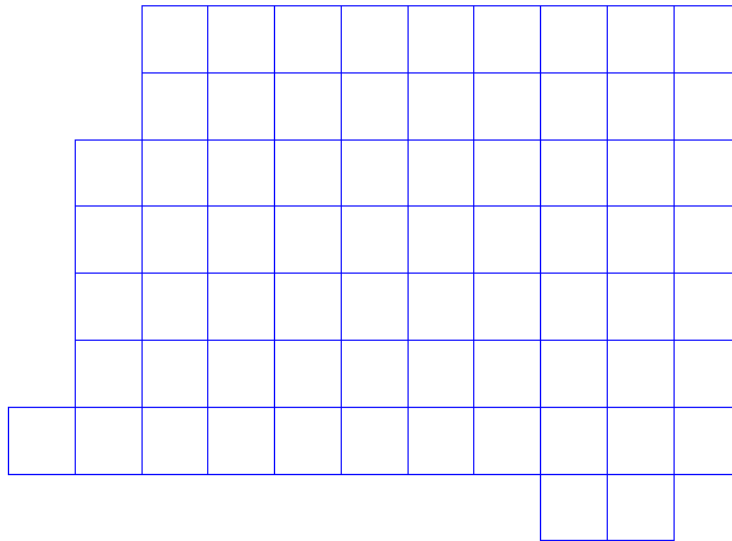
Project Extent:

Project Extent image?



Project Tiling Scheme:

Project Tiling Scheme image?



Contractor:

Aerometric, Inc.

Applicable Specification:

V13; FEMA Memorandum 61

Licensing Restrictions:

None

Third Party Performed QA?

Third Party QA Performed By:

Lounsbery and Associates, Inc.; Alaska Satellite Facility of the Geophysical Institute at UAF.

Project Points of Contact:

POC Name	Type	Primary Phone	E-Mail
Becci Anderson	NSDI Liaison	907-786-7042	irdanderson@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.

- Collection Report
- Survey Report
- Processing Report
- QA/QC Report
- Control and Calibration Points
- Project Shapefile/Geodatabase
- Project Tiling Scheme Shapefile/Gdb
- Control Point Shapefile/Gdb
- Breakline Shapefile/Gdb
- Project XML Metadata

Multi-File Deliverables

File Type	Quantity
<input checked="" type="checkbox"/> Swath LAS Files <input checked="" type="checkbox"/> Required? <input checked="" type="checkbox"/> XML Metadata?	136
<input checked="" type="checkbox"/> Intensity Image Files <input checked="" type="checkbox"/> Required?	273
<input checked="" type="checkbox"/> Tiled LAS Files <input checked="" type="checkbox"/> Required? <input checked="" type="checkbox"/> XML Metadata?	265
<input checked="" type="checkbox"/> Breakline Files <input checked="" type="checkbox"/> Required? <input checked="" type="checkbox"/> XML Metadata?	3
<input checked="" type="checkbox"/> Bare-Earth DEM Files <input checked="" type="checkbox"/> Required? <input checked="" type="checkbox"/> XML Metadata?	69

Additional Deliverables

	Item
<input checked="" type="checkbox"/>	Building footprints in geodatabase and shapefile format.
<input checked="" type="checkbox"/>	2, 10, 20, 50 and 100 foot contours in geodatabase, shapefile and dxf format.
<input checked="" type="checkbox"/>	First return DSM in tif format, with xml metadata for each tif file.
<input checked="" type="checkbox"/>	Hillshades for both bare-earth and first-return surfaces in tif format.

Errors, Anomalies, Other Issues to document? Yes No

Two tiling schemes used, acceptable. DEMs conform to MSB_LiDAR_Imagery_Tiles.shp while classified las files conform to MSB_LiDAR_Imagery_Quarter_Tiles.shp.

Several intensity files located outside of project boundary included in delivery of Lot 1 of 2 Lots. This accounts for the difference in total number of tiled las files and tiled intensity image files. Acceptable.

No swath las files delivered. Reviewer received swath las files on 2/8/2013. The delivered are greater than 2GB in size. Additional swath files requested on 2/19/13. Corrections received 3/7/13, accepted.

No swath xml metadata delivered to reviewer. USGS Base Spec v13 requires, "Product metadata (FGDC compliant, XML format metadata). One file for each of the following: Project, Lift, and Tiled deliverable product group." The reviewer at NGTOC did receive an xml file named, "Point_MacKenzie_Point_Clouds.xml", however this file contained information related to the classified las tiled deliverable group only, not the raw swath las files. Xml metadata for the raw swath las files must be delivered prior to acceptance. Received by NGTOC 3/6/13, accepted.

Checkpoint shapefile and vertical accuracy testing/reporting will be delivered with Lot 2, once entire project area has been processed.

Project Geographic Information

Areal Extent:

583

Sq Mi

Grid Size:

1

meters

Tile Size:

varies

Select...

Nominal Pulse Spacing:

1

meters

Vertical Datum: U.S. feet

Horizontal Datum: U.S. feet

Project Projection/Coordinate Reference 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
- Checkpoints Shapefile/Geodatabase
- Project XML Metadata File
- Swath LAS XML Metadata File
- Classified LAS XML Metadata File
- Bare-Earth DEM XML Metadata File
- Swath LAS Files
- Classified LAS Files
- Breaklines Files
- Bare-Earth DEM Files

Check Point Shapefile/Geodatabase CRS

No checkpoint shapefile delivered. Will be delivered with Lot 2.

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:

H. Boggs

Review Start Date:

8/6/2012

Action to Contractor Date	Issue Description	Return Date
8/7/2012	Feedback regarding Point MacKenzie Block pilot delivery. Corrections requested. Multiple telecons.	2/11/2013
2/19/2013	Multiple corrections requested	3/7/2013

Review Complete: 3/8/2013

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 without errors.

The Swath LAS 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.

Empty rectangular box for input or drawing.

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 notable 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

Image?

Vertical accuracy testing and reporting to be performed by vendor after entire project is processed, will deliver with Lot 2 of 2.

Image?

Checkpoint shapefile used to test and report vertical accuracy will be delivered with Lot 2 of 2, once the entire project area has been processed.

Image?

Delivered xml metadata provides some accuracy information which is included below. Reviewer at NGTOC will perform independent accuracy assessment during QA of Lot 2 of 2. Point MacKenzie block is delivery Lot 1 of 2.

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	<input type="text" value="N/A"/>	<input type="text" value="centimeters"/>
Brush Lands and Low Trees	<input type="text" value="N/A"/>	<input type="text" value="centimeters"/>
Forested Areas Fully Covered by Trees	<input type="text" value="N/A"/>	<input type="text" value="centimeters"/>
Urban Areas with Dense Man-Made Structu...	<input type="text" value="N/A"/>	<input type="text" value="centimeters"/>

The reported CVA of this data set is: .

LAS Swath File Review

LAS swath files or raw unclassified LiDAR data are reviewed to assess the quality control used by the data supplier during collection. Furthermore, LAS swath data are checked for positional accuracy. The data supplier should have calculated the Fundamental Vertical Accuracy using ground control checkpoints measured in clear open terrain. The following was determined for LAS swath data for this project:

LAS Version

- LAS 1.2 LAS1.3 LAS 1.4

Swath File Characteristics

- Separate folder for LAS swath files
 Each swath files <= 2GB
 *If specified, *.wdp files for full waveform have been provided

The reported FVA of the LAS swath data is .

Based on this review, the USGS accepts the LAS swath file data.

Yes No

Image?

Task order references USGS Base Spec v13 which requires each swath file be assigned a unique file source ID. No file source ID assigned to delivered swath las files. Corrections requested 2/19/13. Received 3/7/13, accepted.

Image?

Swath files must be split into segments no greater than 2GB. Corrections requested 2/19/13. Received 3/7/13, accepted.

Image?

No swath las files delivered. Reviewer received 28 swath las files on 2/8/2013. The delivered swath cover only a portion of the total project area. Additional swath files requested on 2/19/13. Received 3/7/13, accepted.

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

Based on this review, the USGS accepts the classified LAS tile file data.

Errors, Anomalies, Other Issues to document? Yes No

None.

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.

Errors, Anomalies, Other Issues to document? Yes No

Image for error?

Breakline file, "Single_Line_Drains_All_Areas.shp" delivered in 2D format. Polyline Z format required. Corrections received 3/7/13, accepted.

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

		Fundamental		
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Land Cover Category	# of Points	Vertical Accuracy @95% Confidence Interval (Accuracy _z) Required FVA = 24.5 or less.	Supplemental Vertical Accuracy @95th Percentile Error Target SVA = 36.3 or less.	Consolidated Vertical Accuracy @95th Percentile Error Required CVA = 36.3 or less.
Open Terrain	20	N/A		
Tall Weeds and Crops	1		N/A	
Brush Lands and Low Trees	1		N/A	
Forested Areas Fully Covered by Trees	1		N/A	
Urban Areas with Dense Man-Made Structures	1		N/A	
Consolidated	20			N/A

QA performed Accuracy Calculations?

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.

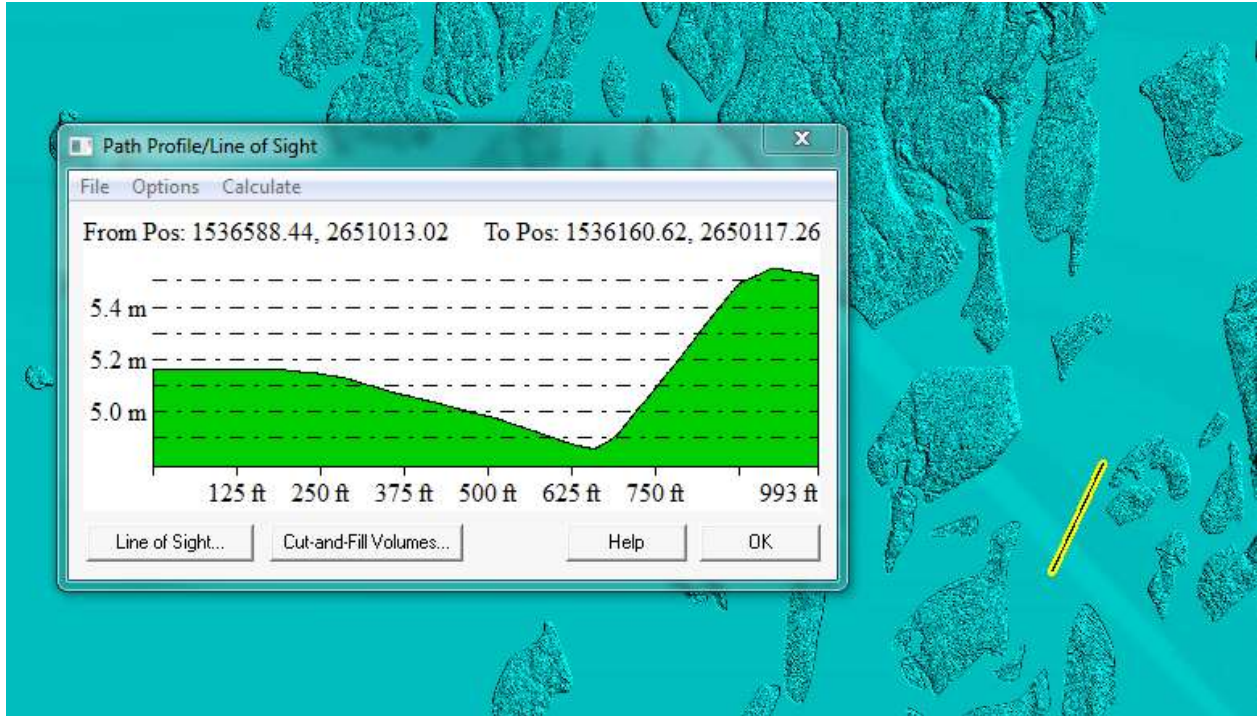
Bare-Earth DEM Anomalies, Errors, Other Issues

Errors, Anomalies, Other Issues to document? Yes No

Image?

Vertical accuracy testing and reporting to be performed by vendor after all seven blocks are processed. Will deliver with Block 7, the final delivery.

Image?



Downstream constraint not maintained in areas affected by tidal waters. Acceptable.

Internal Note:

This is the end of the report.

QA Form V1.4 12OCT11.xsn