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 NGTOCoperations@usgs.gov.

Materials Received:
8/30/2012

Project Type: Donated Data

Project ID:
ID_Laundry-China-Osier_2010

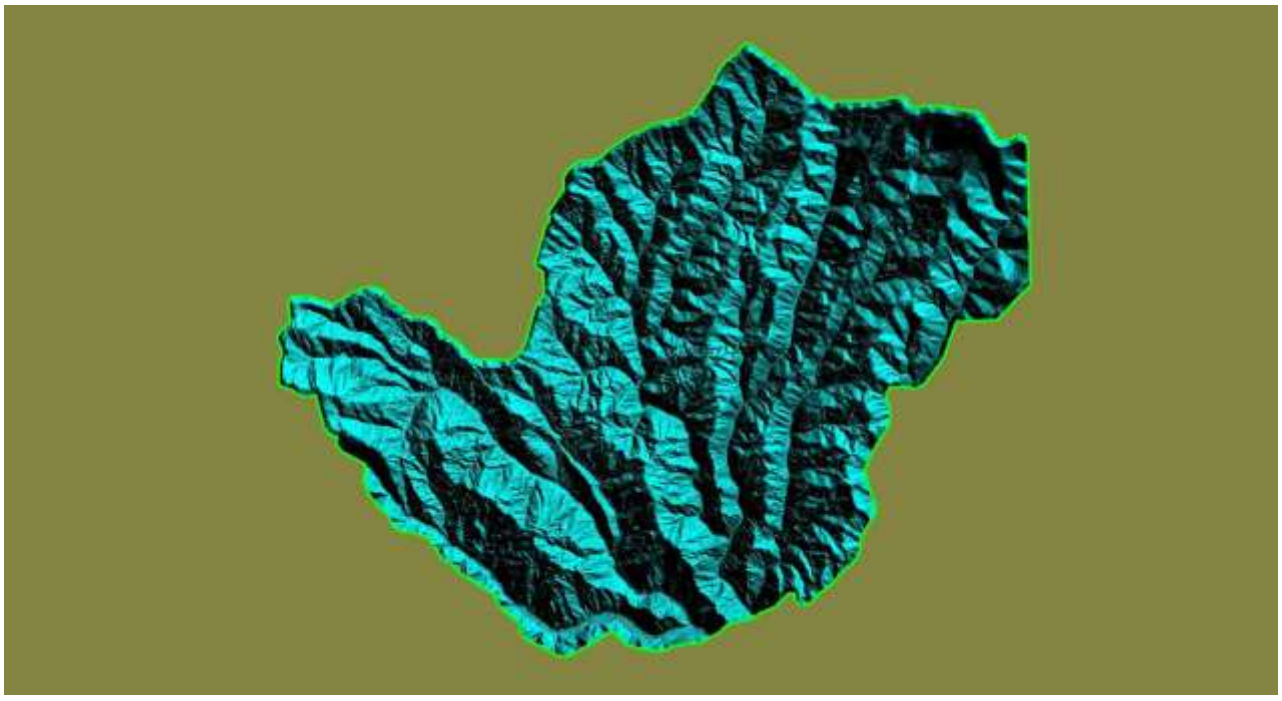
Project Description:
LiDAR generated point cloud acquired in 2010. Twenty six square mile area encompassing Laundry China Osier ID.

Project Alias(es):

Year of Collection: 2010

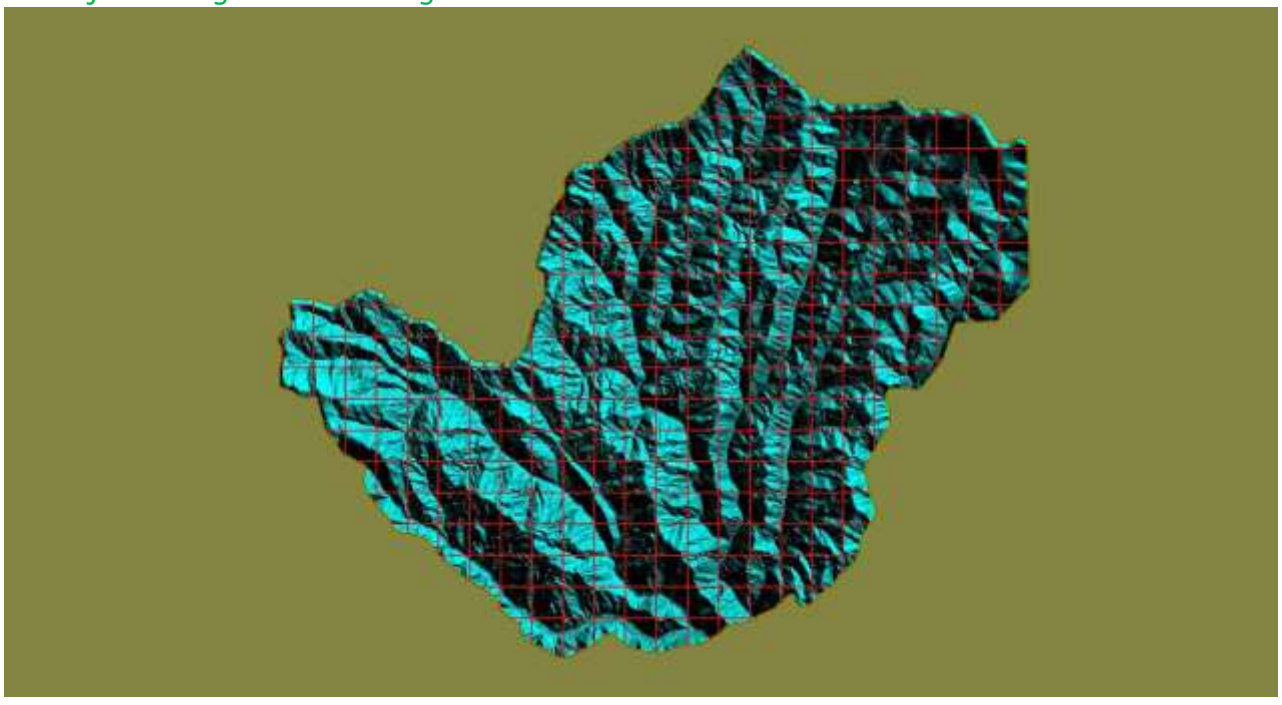
Lot 1 of 1 lots.

Project Extent:
☑ Project Extent image?



Project Tiling Scheme:

☑ Project Tiling Scheme image?



Contractor:	Applicable Specification:
Watershed Sciences, Inc.	V13

Licensing Restrictions:

None

☐ Third Party Performed QA?

Project Points of Contact:

POC Name	Type	Primary Phone	E-Mail
Scott Van Hoff	NSDI Liaison	(208) 387-1351	svanhoff@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.

- [x] Collection Report
- [x] Survey Report
- [x] Processing Report
- [ ] QA/QC Report
- [ ] Control and Calibration Points
- [x] Project Shapefile/Geodatabase
- [ ] Control Point Shapefile/Gdb
- [x] Project Tiling Scheme Shapefile/Gdb
- [ ] Breakline Shapefile/Gdb
- [ ] Project XML Metadata
- [ ] Swath LAS XML Metadata
- [ ] Classified LAS XML Metadata
- [ ] Breakline XML Metadata
- [x] Bare-Earth DEM XML Metadata

Multi-File Deliverables

File Type	Quantity
[ ] Swath LAS Files	
[ ] Intensity Image Files	
[x] Tiled LAS Files	296
[ ] Breakline Files	
[x] Bare-Earth DEM Files	1

Additional Deliverables

Errors, Anomalies, Other Issues to document? ○ Yes ◉ No

None.

Project Geographic Information

Areal Extent:

26

Sq Mi

Grid Size:

1

meters

Tile Size:

500 x 500 = LAS files

meters

Nominal Pulse Spacing:

4

meters

Vertical Datum: NAVD88 meters

Horizontal Datum: NAD83 meters

Project Projection/Coordinate Reference System: UTM Zone 11 NAD 83 meters.

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

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

Check Point Shapefile/Geodatabase CRS

Not sent

Project XML Metadata CRS

Not sent

Swath LAS XML Metadata CRS

Not sent

Classified LAS XML Metadata CRS

Not sent

Breakline XML Metadata CRS

Not sent

Swath LAS Files CRS

Not sent

Breakline Files CRS

Not sent

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:
E. Jaramillo

Review Start Date:
11/7/2012

Action to Contractor Date	Issue Description	Return Date

Review Complete: 11/13/2012

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 with errors.

No Project XML Metadata sent.

The Bare-Earth DEM XML Metadata file parsed with errors.

Type	Description or line numbers	Line(s (or count

Severity 5: Misplaced elements		
Error	Lineage (2.5) is not permitted in Metadata (0)	197
Severity 3: Missing elements		
Error	Attribute_Definition (5.1.2.2) is required in Attribute (5.1.2)	144 147
Error	Attribute_Definition_Source (5.1.2.3) is required in Attribute (5.1.2)	144 147
Error	Attribute_Domain_Values (5.1.2.4) is required in Attribute (5.1.2)	144 147
Error	Digital_Transfer_Option (6.4.2.2) is required in Digital_Form (6.4.2)	166
Error	Distribution_Liability (6.3) is required in Distribution_Information (6)	152
Error	Entity_Type_Definition (5.1.1.2) is required in Entity_Type (5.1.1)	134
Error	Entity_Type_Definition_Source (5.1.1.3) is required in Entity_Type (5.1.1)	134
Error	Entity_Type_Label (5.1.1.1) is required in Entity_Type (5.1.1)	134
Error	Fees (6.4.3) is required in Standard_Order_Process (6.4)	165
Error	Format_Name (6.4.2.1.1) is required in Digital_Transfer_Information (6.4.2.1)	167
Error	Horizontal_Positional_Accuracy_Report (2.4.1.1) is required in Horizontal_Positional_Accuracy (2.4.1)	77
Error	Horizontal_Positional_Accuracy_Value (2.4.1.2.1) is required in Quantitative_Horizontal_Positional_Accuracy_Assessment (2.4.1.2)	78
Error	Place_Keyword_Thesaurus (1.6.2.1) is required in Place (1.6.2)	51
Error	Process_Date (2.5.2.3) is required in Process_Step (2.5.2)	90 95
Error	Process_Step (2.5.2) is required in Lineage (2.5)	197
Error	Vertical_Positional_Accuracy_Report (2.4.2.1) is required in Vertical_Positional_Accuracy (2.4.2)	82

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 acceptsthe quality of the checkpoint data for these LiDAR datasets.

Errors, Anomalies, Other Issues to document? (•) Yes ( ) No

☐ Image?

Contractor compared the laser points and RTK hard surface survey points and reports FVA for Laundry China Osier as 0.089 meters.

☐ Image?

SVA values reported in table below were NOT calculated using the 95th percentile and were calculated using the FVA 95th confidence interval.

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: meters

Required FVA Value is 0.294 meters or less.
Target SVA Value is n/a meters or less.
Required CVA Value is n/a meters or less.

The reported FVA of the LAS Swath data is **n/a** meters.

The reported FVA of the Bare-Earth DEM data is **n/a** meters.
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		meters
Brush Lands and Low Trees		meters
Forested Areas Fully Covered by Trees		meters
Urban Areas with Dense Man-Made Structur...		N/A

The reported CVA of this data set is: n/a meters.

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 n/a meters.

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

Errors, Anomalies, Other Issues to document? (•) Yes ( ) No

- [ ] Image?

No Swath .las files were sent.

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

- [x] Separate folder for Classified LAS tile files
- [x] Classified LAS tile files conform to Project Tiling Scheme
- [x] Quantity of Classified LAS tile files conforms to Project Tiling Scheme
- [x] Classified LAS tile files do not overlap
- [x] Classified LAS tile files are uniform in size
- [x] 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?

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 does not accept at this time the breakline files.

Errors, Anomalies, Other Issues to document? ◉ Yes ○ No

☐ Image for error?

No breaklines were sent.

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: .ADF

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 meters.

Reported Accuracies

Land Cover Category	# of Points	Fundamental Vertical Accuracy @95% Confidence Interval ($Accuracy_z$) Required FVA = 0.294 or less.	Supplemental Vertical Accuracy @95th Percentile Error Target SVA = n/a or less.	Consolidated Vertical Accuracy @95th Percentile Error Required CVA = n/a or less.
Open Terrain		**n/a**		
Tall Weeds and Crops				
Brush Lands and Low Trees				
Forested Areas Fully Covered by Trees				
Urban Areas with Dense				

Man-Made Structures				
Consolidated	0			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?

No Break lines for this data, water is NOT hydro flattened.

Internal Note:

This is the end of the report.

QA Form V1.4 12OCT11.xsn