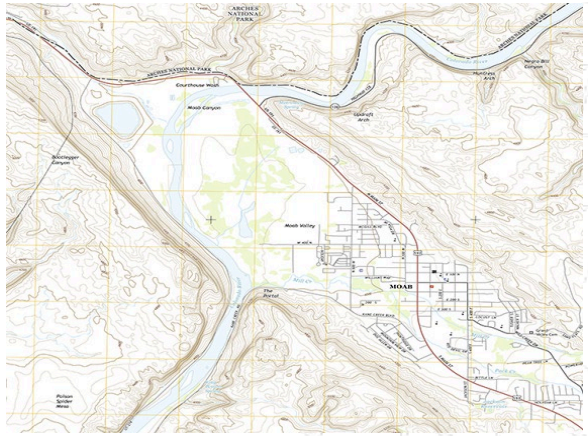
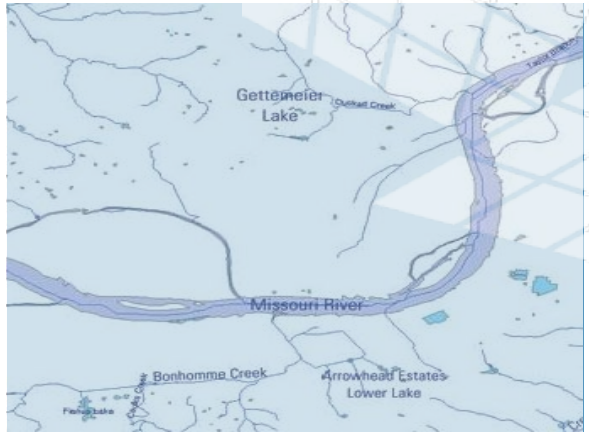
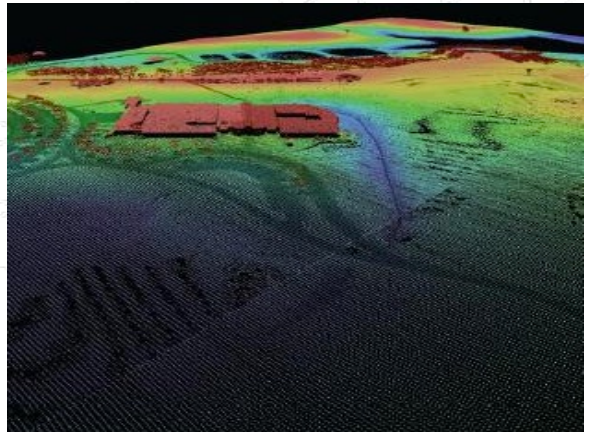
GPSC Technical Exchange







Josh Nimetz
National Geospatial Program | National Geospatial Technical Operations Center
Virtual Web Conference
March 8, 2022

Topics for discussion

- Check point and control point geopackage template
- Documentation of process to create MSHR or other withheld flag proof of performance within lidar mapping reports
- Changing requirements for spatial resolution of MSHRs
- Reminder to submit SSI and withheld flag proof of performance (e.g. MSHR) or every redelivered LPC file
- Overlap between work units – Update
  - Between all work units
  - Between work units of varying quality levels (QL)
- Reminder to check 3DEP Lidar Base Specification or update
  - https://www.usgs.gov/ngp-standards-and-specifications/lidar-base-specification-revision-status
- Access to TEM materials – slides, recordings, etc
  - https://rockyweb.usgs.gov/outgoing/3DEP_TEM/

USGS science for a changing world

The National Map
Your Source for Topographic Information

New Check Point/Control Point GPKG

File: Geopackage with a Points Layer that is Z enabled | **File Naming Convention:** PRJ(full name)_Survey_Points

Attribute Field (Name)	Attribute Field (Type/format)	Field length / limitation	Comment
fid	Object ID \ Integer64		Required
unique_identifier	string	No limitation	Required – unique identifier that distinguishes the point from all other points and is consistent with how the point is identified in associated survey reports and images
point_type	string	10 characters	Required – only be populated with one of the following attributes: NVA, VVA, control, or BVA
comment	string	No limitation	Optional – Where appropriate [i.e. bathymetry checkpoint at water edge)
collection_date	date	yyyy-mm-dd	Required
source_geoid	string	No limitations	Required
source_horizontal_epsg	long \ integer	No limitations	Required
source_horizontal_unit	string	No limitations	Required
source_vertical_epsg	long \ integer	No limitations	Required
source_vertical_unit	string	No limitations	Required
source_easting	double \ real	3 decimal places	Required – Precision not to exceed 3 decimal places
source_northing	double \ real	3 decimal places	Required – Precision not to exceed 3 decimal places
source_elevation	double \ real	3 decimal places	Required – Precision not to exceed 3 decimal places
project_id	long \ integer	No limitations	Required – PTS ID (Project / WP)

New Check Point/Control Point GPKG

GeoPackage Coordinate Reference System Requirements

Coordinate Reference System

- GeoPackage shall be in the same CRS as the lidar data.
- CRS information in geopackage files shall use WKT as defined in OGC (2001). All other WKT specifications, including Esri, ISO, and OGC (2015) are expressly forbidden.
- GDAL version 2.4.1 or later or as otherwise agreed to in advance and specified in the Task Order, shall be used to populate the gpkg_spatial_ref_sys_table of the geopackage as defined in OGC GeoPackage Encoding Standard (2021).
- The vertical system name shall include the geoid model used to convert from ellipsoid heights to orthometric heights.
- For verification or generation of properly formatted WKT, the USGS recommends the use of the gdalsrsinfo (http://www.gdal.org/gdalsrsinfo.html) tool. gdalsrsinfo is a command line tool that can be downloaded and installed using the OSGeo4W installer (https://trac.osgeo.org/osgeo4w/). The following command will produce WKT that the USGS considers to have valid form: **$ gdalsrsinfo -o wkt "EPSG:<code>"** (i.e., gdalsrsinfo -o wkt EPSG:6557 + 5103). However, the USGS recommends four exceptions to the gdalsrsinfo output:
  - gdalsrsinfo adds an EXTENSION[] tag to capture geoid information in the VERT_DATUM[] section that is not defined in the WKT specification. Data providers shall remove the EXTENSION[] tag if it is shown.
  - In cases where the datum name output from gdalsrsinfo differs from that listed in the EPSG Registry database (https://epsg.org/home.html), the USGS would prefer that the name be changed to match the EPSG Registry; however, the GDAL output will be accepted. For example, EPSG:1116 is named "NAD83_National_Spatial_Reference_System_2011" in the output from GDAL but the name on EPSG Registry is "NAD83 (National Spatial Reference System 2011)" and the only listed alias is "NAD83(2011)"
  - For all projected coordinate systems, the USGS recommends WKT (OGC, 2001) default values: AXIS["X",EAST], AXIS["Y",NORTH]; however, the GDAL output ("Easting" and "Northing" rather than "X" and "Y") will be accepted.
  - gdalsrsinfo and EPSG outputs use "metre" instead of the U.S. convention "meter." Either spelling is acceptable to the USGS.
- The USGS recognizes that the GDAL tool is not a rigorous standards-based solution, but it is a mutually convenient open-source tool suitable for 3DEP purposes at this time. Following are the USGS directions for specific WKT format and content:
  - The vertical CRS shall be included in the CRS.
  - The geoid name shall be appended to the VERT_CS[]. For example: VERT_CS["NAVD88 height (ftUS) - GEOID18"]
  - Horizontal and vertical CRS shall be wrapped within a COMPD_CS.
  - The EPSG AUTHORITY[] tag shall not be included for the compound coordinate system.
  - User-defined entities will not be allowed for capturing geoid information in the WKT (for example, GEOID_MODEL[]). These nonstandard entity entries are not consistently machine readable.
  - All elements of the CRS record shall include the EPSG AUTHORITY[] entry and a valid EPSG code, except where no EPSG code exists for the element or where otherwise excluded from this requirement within this specification.

New Check Point/Control Point GPKG

Required Geopackage Attribute Fields

General | Fields | XY Coordinate System | Indexes

Field Name	Data Type
fid	Object ID
geom	Geometry
unique_identifier	Text
point_type	Text
comment	Text
collection_date	Date
source_geoid	Text
source_horizontal_epsg	Long Integer
source_horizontal_unit	Text
source_vertical_epsg	Long Integer
source_vertical_unit	Text
source_easting	Double
source_northing	Double
source_elevation	Double
project_id	Long Integer

NVA, VVA, control, or BVA

Field must be present in the attribute table but is not required to be populated.

yyyy-mm-dd

Precision reported is limited to 3 decimal places

Number generated by USGS, and Field populated by contractor

New Check Point/Control Point GPKG

Example GeoPackage Attribute Table

Example populated attribute table

	fid	unique_identifier	point_type	comment	collection_date	source_geoid	source_horizontal_epsg	source_horizontal_unit	source_vertical_epsg	source_vertical_unit	source_easting	source_northing	source_elevation	project_id
1	1	VVA1	VVA	NULL	2021-07-16	GEOID 18	6511	meter	5703	meter	566333.853	235695.098	326.136	777777
2	2	VVA001	VVA	NULL	2021-07-16	GEOID 18	6511	meter	5703	meter	566338.67	235646.928	323.088	777777
3	3	NVA_1	NVA	NULL	2021-07-12	GEOID 18	6511	meter	5703	meter	566367.572	235530.115	317.906	777777
4	4	NVA1	NVA	NULL	2021-07-13	GEOID 18	6511	meter	5703	meter	566447.053	235530.115	317.602	777777
5	5	NVA1b	NVA	NULL	2021-07-08	GEOID 18	6511	meter	5703	meter	566347.1	235467.494	318.821	777777
6	7	BVA 12	BVA	Bathymetry Checkpoint	2021-07-17	GEOID 18	6511	meter	5703	meter	565299.397	235457.86	320.04	777777
7	9	BE1	NVA	NULL	2021-07-05	GEOID 18	6511	meter	5703	meter	566354.325	235451.839	318.211	777777

MSHR or other withheld flag proof of performance - Documentation

- Write-up in lidar mapping report
- Currently submitted to the ESRB for inclusion in future LBS
- Similar to what is required for swath separation imagery

USGS is looking or documentation for MSRHs or other withheld flag proof of performance products, using SSI write-up for example:

- Graphics and statistics to support interswath accuracy assessment to include:
  - Swath separation image graphics and write-up of processes and settings used to create these images. Settings to be documented include image GSD, color ramp values, points used, surface algorithm (TIN, point-in-cell, other). This can be documented with a screenshot embedded in the document.
  - Reporting of other methodologies for assessing interswath and any supporting statistics.
- Any additional graphics and statistics the contractor believes may be of value in conveying relative accuracy of the point cloud data.

MSHR – Spatial Resolution

- USGS will now accept MSHRs with spatial resolution (pixel size) up to 4 * NPS
- Intent is to make sure pixels contain valid signal and are not void
  - Exceptions to this are for areas where voids are expected such as over open water
- This is similar to spatial resolution requirement for SSIs

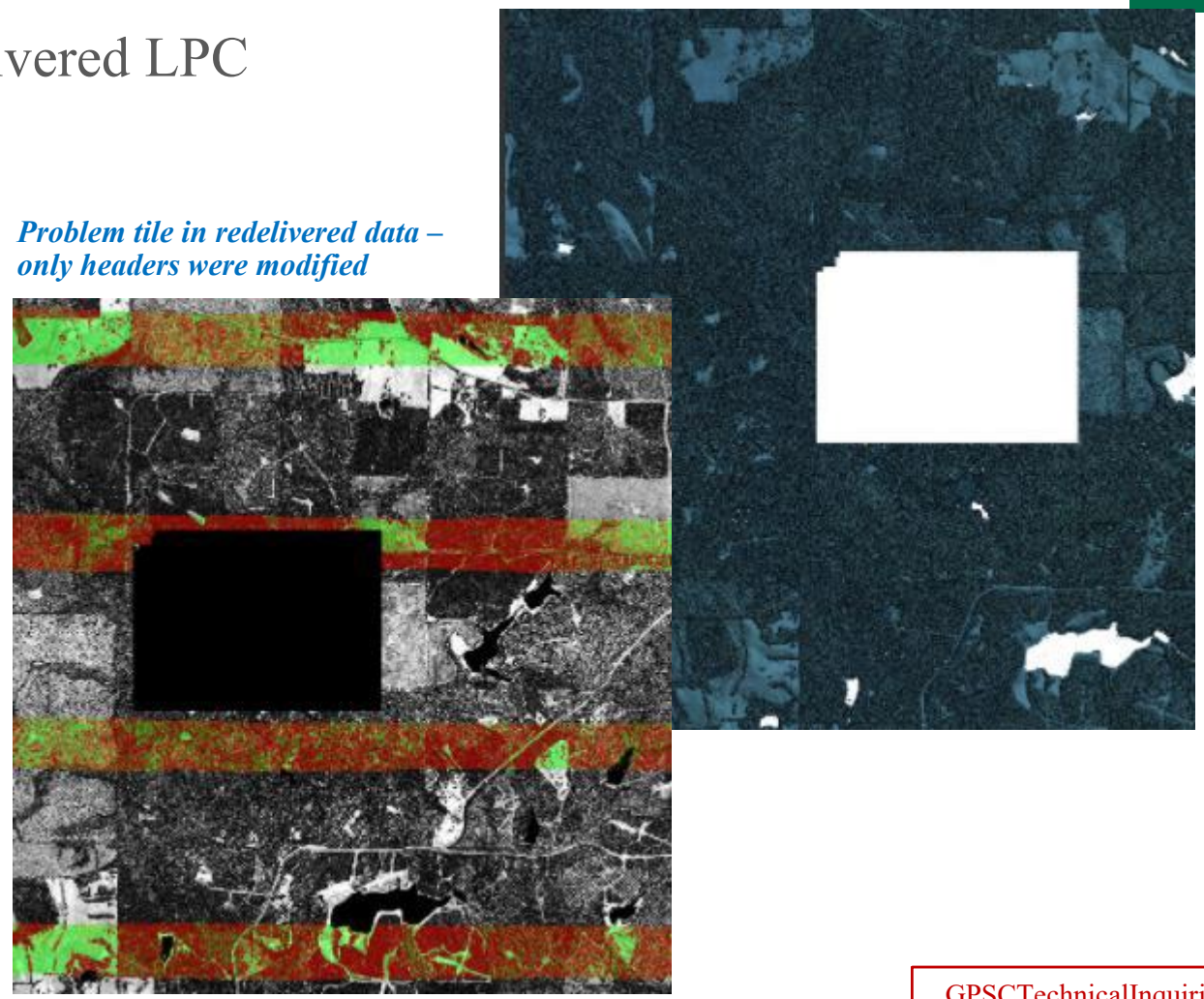
Updated MSHR spatial resolution intended to follow existing requirements for SSIs (see LBS language here for reference)

- Spatial extent and coordinate reference system:
  - Spatial resolution (pixel dimension) of the images shall be no greater than 4 times the Nominal Pulse Spacing (4 x NPS) in the project's linear unit (meters or feet).
  - The difference images must be representative of the associated data delivery.
  - The images shall be in the same CRS as the point cloud data to ensure alignment with the point cloud.

MSHR or other withheld flag proof of performance and SSI Delivery

- Reminder – USGS needs these rasters redelivered along with updated lidar point cloud data
- Redelivery of these files 1:1 for every redelivered LPC

Problem tile in redelivered data – only headers were modified



+ Overlap between work units - Update

- USGS now requires 100 pixel (minimum) overlap between work units of varying quality levels (QL)
- This is in addition to 100 pixel (minimum) overlap between work units with different EPSG codes

Graphics taken directly from "Boundary Operating Procedures_Updated_2_22_22.pptx"

- **Project SUB-Tile Indices** (QL tiles are different sizes)
  ST_ProjectName_YEAR_B21_QL1_TI
  - Separate tile indices per quality level, attributed with QL information
  - Clipped to QL extent
  - Same CRS as data
  - Minimum 100-pixel overlap is required between quality levels (updated 2/22/22)

Example: Overlapping Tile Indices Across a UTM Zone Boundary

Some overlap is needed across zone boundaries and between differing quality levels to facilitate raster processing of DEMs. A minimum 100-pixel buffer beyond each zone/QL

Overlap between work units - Update

- During 20 Jan 2022 3DEP TEM, 100 pixel overlap between *all* work units was discussed
- USGS is currently researching options to handle this matter internally
- 100 pixel overlap between *all* work units is not currently required
  - However, 100 pixel overlap between work units of varying EPSG codes or quality levels is required

+ Lidar Base Specification - update

- Reminder to review LBS revisions page
  - https://www.usgs.gov/ngp-standards-and-specifications/lidar-base-specification-revision-status
- USGS is moving to a new listserv for email notifications
  - No action required – current emails on file should be ported over to new system
  - You may still use current sign-up: https://listserv.usgs.gov/mailman/listinfo/3dep_lidar_spec_news

Revisions being considered for the Lidar Base Specification

Short name of revision	Status	Last updated
Consistent units of reference	Approved by ESRB	December 13, 2021
No classification codes to identify overlap points	Approved by ESRB	September 14, 2021
Survey point delivery	Approved by ESRB	December 13, 2021
Drop delivery of waveform data	Approved by ESRB	December 13, 2021

Thank You!
Let's Talk…

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