DPH-8 Report on Smooth Surface Precision (intraswath)

The USGS Lidar Base Specification 2023 rev. A states: "Precision will be calculated as: Precision = Range - (Slope x Cellsize x 1.414) where:
- Precision, Range, and Slope are rasters (square cells assumed);
- Range is the difference between the highest and lowest lidar points in each pixel;
- Slope is the maximum slope of the cell to its 8 neighbors, expressed as a decimal value, calculated from the minimum elevation in each cell; and
- Cellsize is the edge dimension of the cell. 1.414 is the factor to compute the diagonal dimension of the pixel.
- Cellsize is set to the ANPS, rounded up to the next integer, and then doubled:
  Cellsize = CEILING(ANPS) × 2, where CEILING is a function to round ANPS up to the next integer.

Assessment of precision will be made on hard surfaced areas (for example, parking lots or large rooftops) containing only single return lidar points. Sample areas for assessment of precision will be approximately 100 pixels. To the degree allowed by the data and the project environment, multiple sample areas representing the full width of the swath(s) (left, center, and right) will be examined. Multiple single swaths from a single lift may be used if needed to sample the full swath width. At a minimum, precision shall be assessed against for each lift of each aircraft/instrument combination used on the project. Additional areas may be checked at the discretion of the USGS–NGP. Each test area will be evaluated using a signed difference raster with a cell size equal to the ANPS, rounded up to the next integer, then doubled (Cellsize=CEILING(ANPS)×2). The difference rasters will be statistically summarized to verify that root mean square difference in the z direction (RMSDz) values do not exceed the limits set forth in table 2 for the QL of information that is being collected."

Table 2. Relative vertical accuracy for light detection and ranging swath data.

[QL, quality level; $RMSD_z$, root mean square difference in the *z* direction; m, meter; ≤, less than or equal to]

Quality level	Smooth surface repeatability, $RMSD_z$ (m)	Swath overlap difference, $RMSD_z$ (m)
QL0	≤0.03	≤0.04
QL1	≤0.06	≤0.08
QL2	≤0.06	≤0.08
QL3	≤0.12	≤0.16

The purpose of this section is to evaluate smooth surface repeatability / intraswath precision by measuring departures from planarity of single returns from hard planar surfaces, normalizing for actual variation in the surface elevation. Repeatability of clusters of single returns is then assessed at multiple locations within hard surfaced areas (for example, parking lots or large rooftops).

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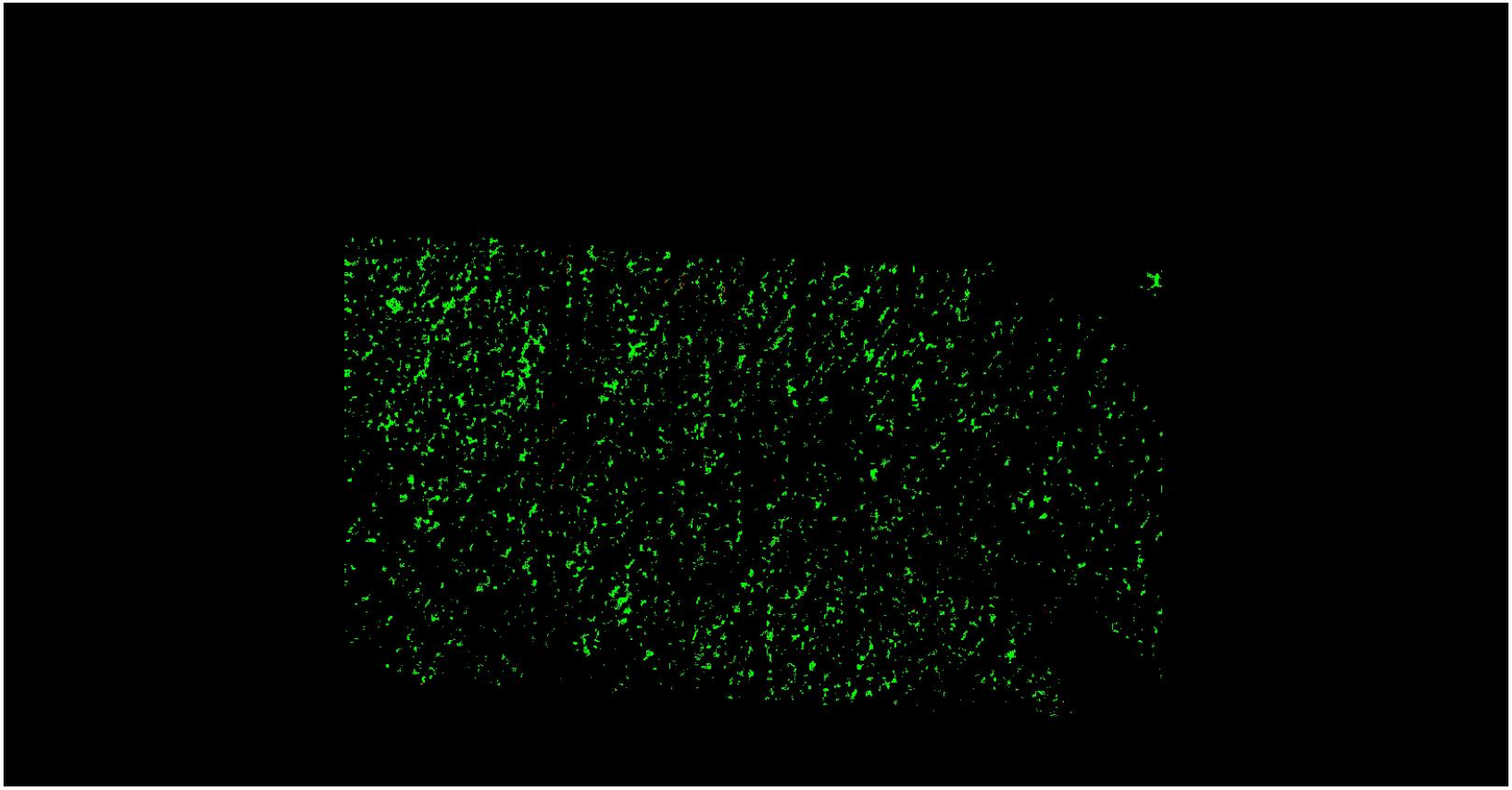

0	0.060	0.600 (Meter)
0	0.197	1.969 (Feet)

A maximum vertical separation cutoff has been applied to this graphic for the purpose of masking out disruptive features that are not applicable for depicting sensor noise within individual swaths (e.g., trees, moving cars, etc.).