# Lidar and GIS - Classification and Feature Extraction

Lindsay Weitz

Dan Hedges

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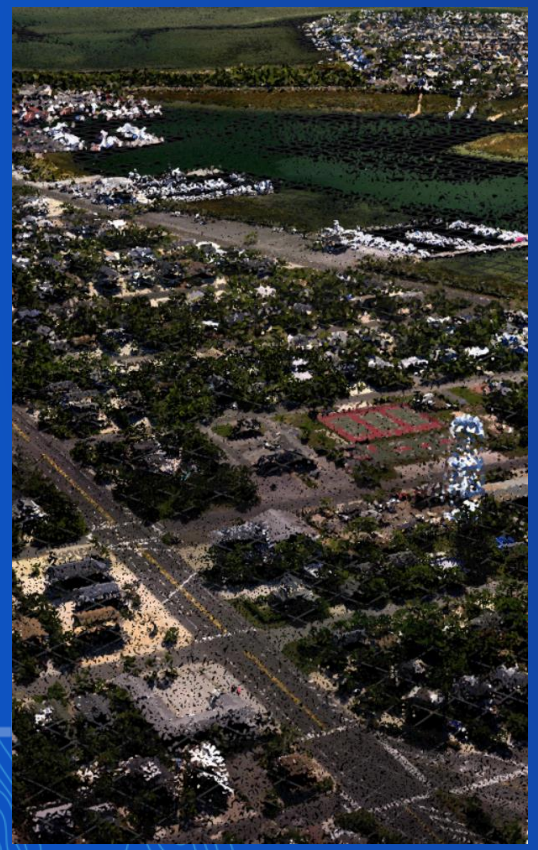
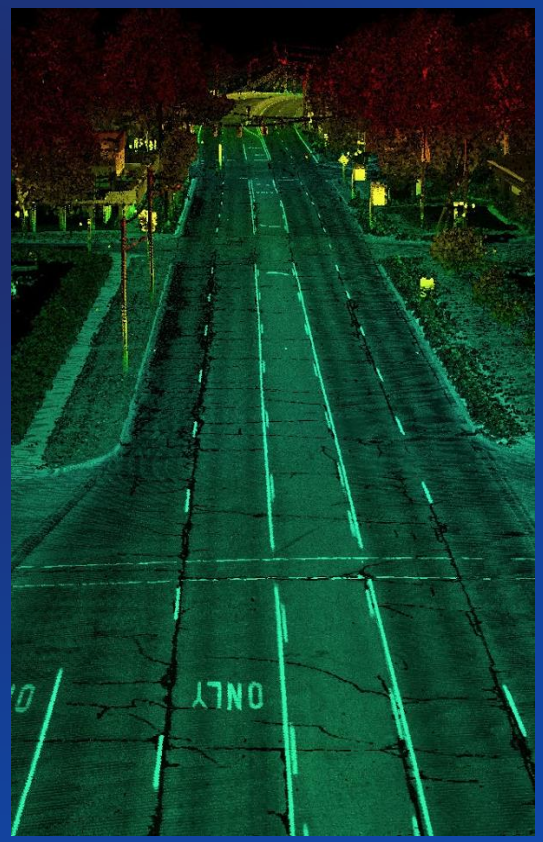
# ArcGIS Supports

## Airborne

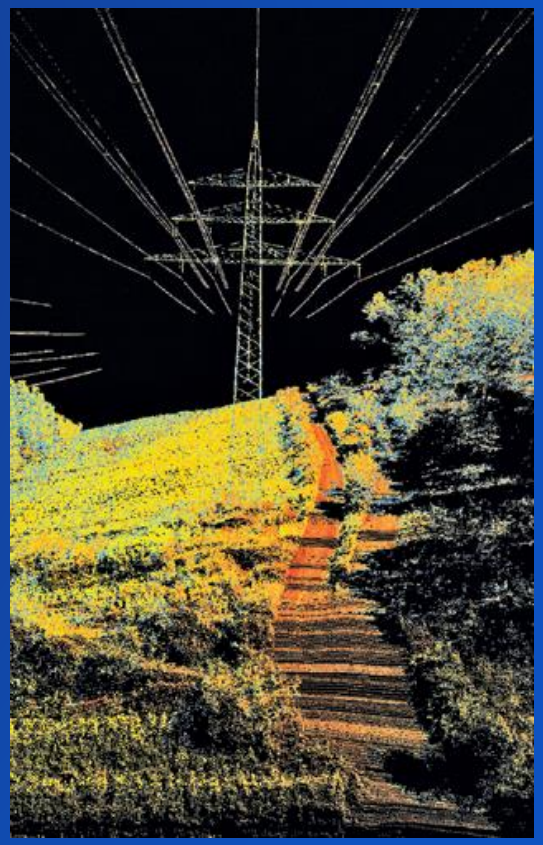


## Terrestrial

## Mobile




## Drone/UAV

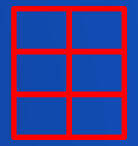


# Data Structures for lidar support in ArcGIS

File01.las
File02.las
…
File99.las

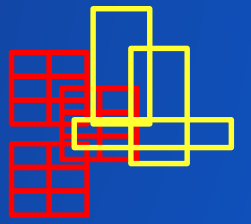
Multiple files/folders

Analyze and Update



**LAS dataset / Terrain dataset**

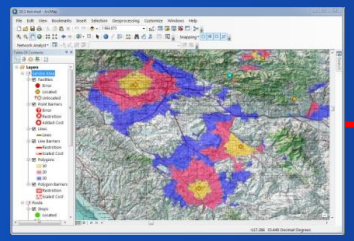
Manage and Share



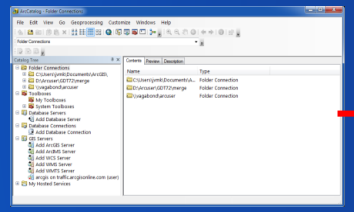
**Mosaic dataset / Point cloud scene layer**

# Application Fusion: ArcGIS Pro

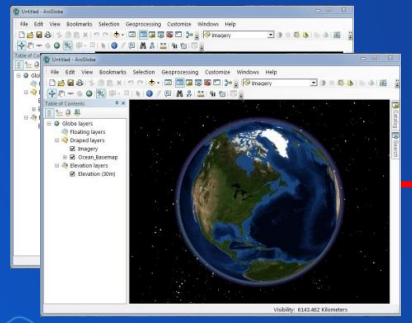
ArcMap

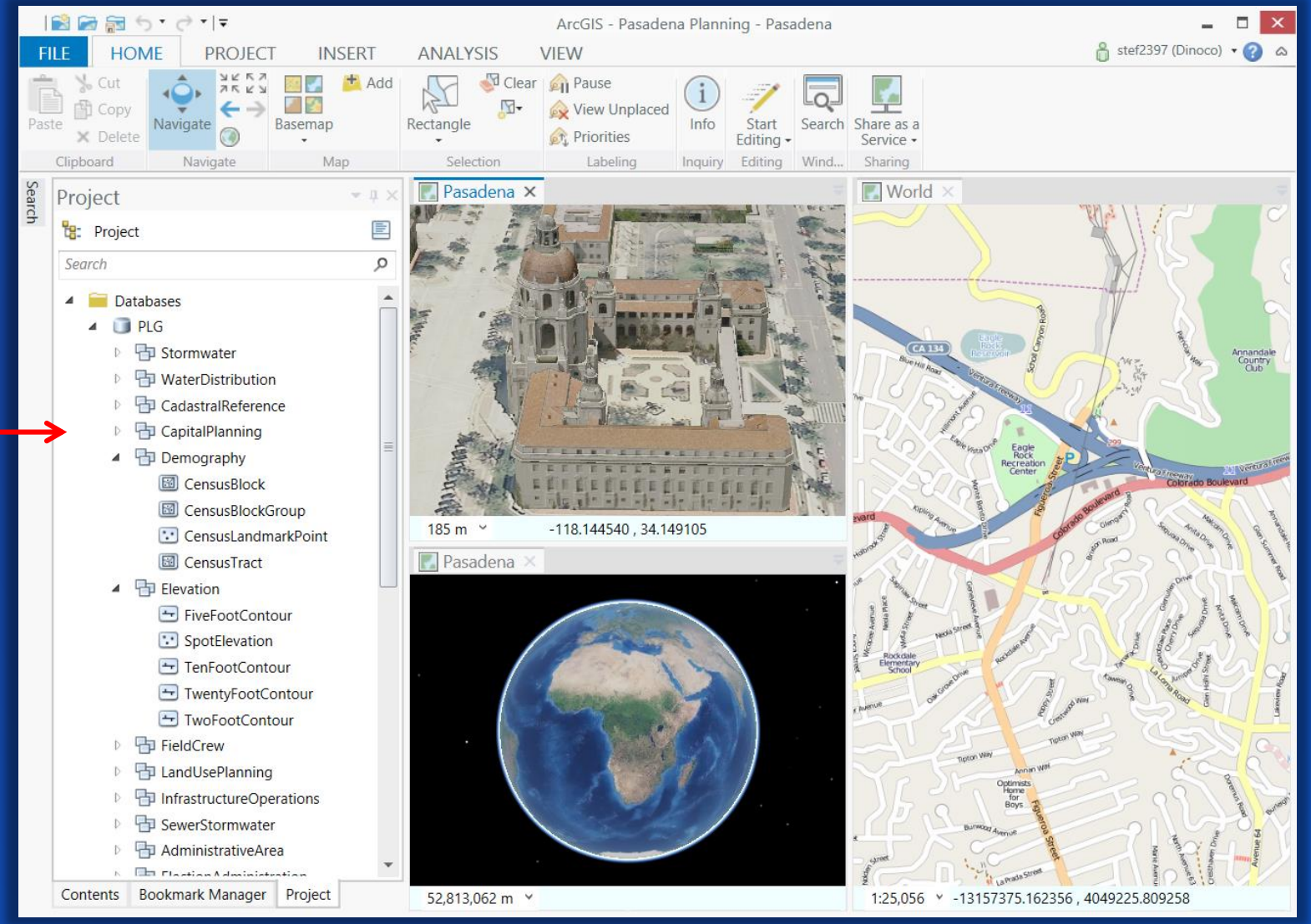


ArcCatalog



ArcGlobe / ArcScene





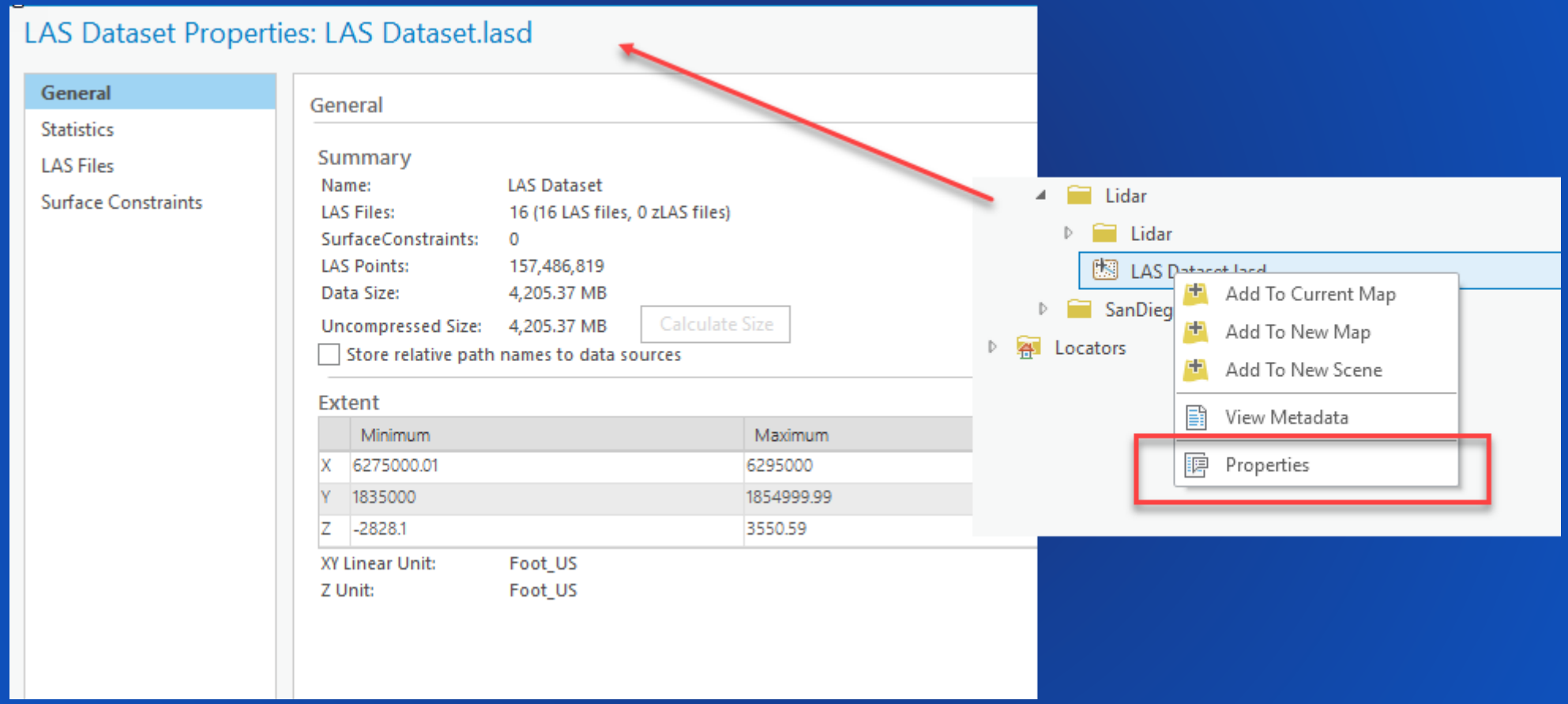
# Lidar data with a LAS dataset

- Direct read of LAS or zLAS format lidar
- File based
- QA/QC tools
- Stores references to LAS/zLAS files on disk
- Optionally reference breakline and control point data
- Treats a collection of LAS/zLAS files as one logical dataset (“Project”)

# Classification codes

- Every lidar point can have a classification that defines the type of object that has reflected the laser pulse.
- Lidar points can be classified into a number of categories.
- The different classes are defined using numeric integer codes in the LAS files.

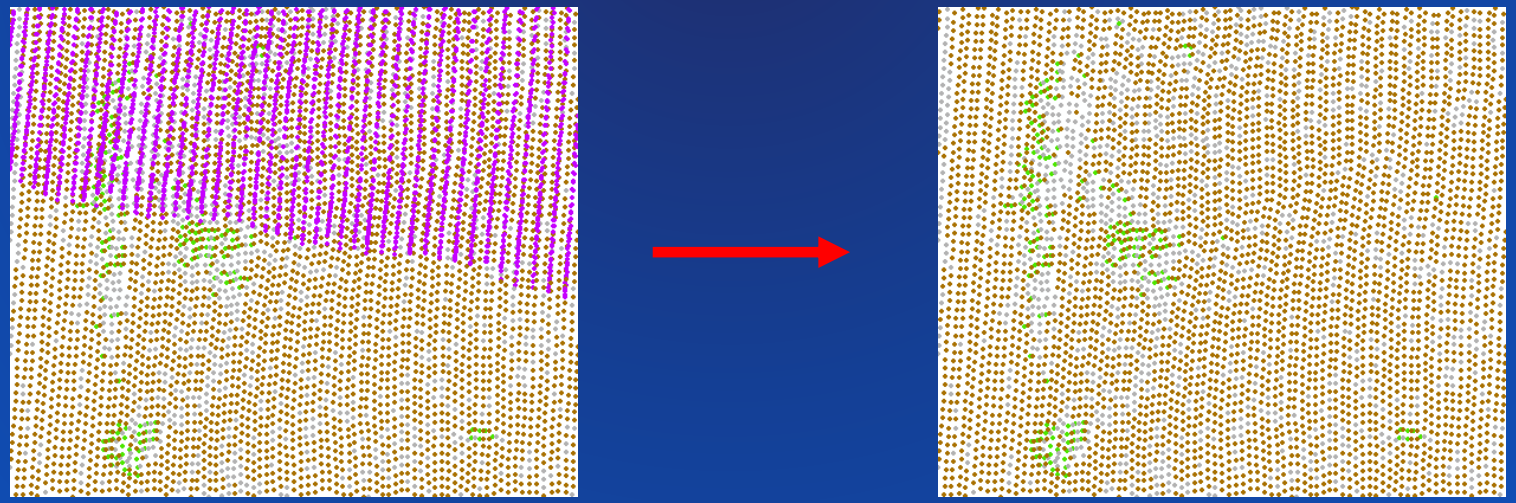
# LAS Dataset Properties



# Classify LAS Overlap

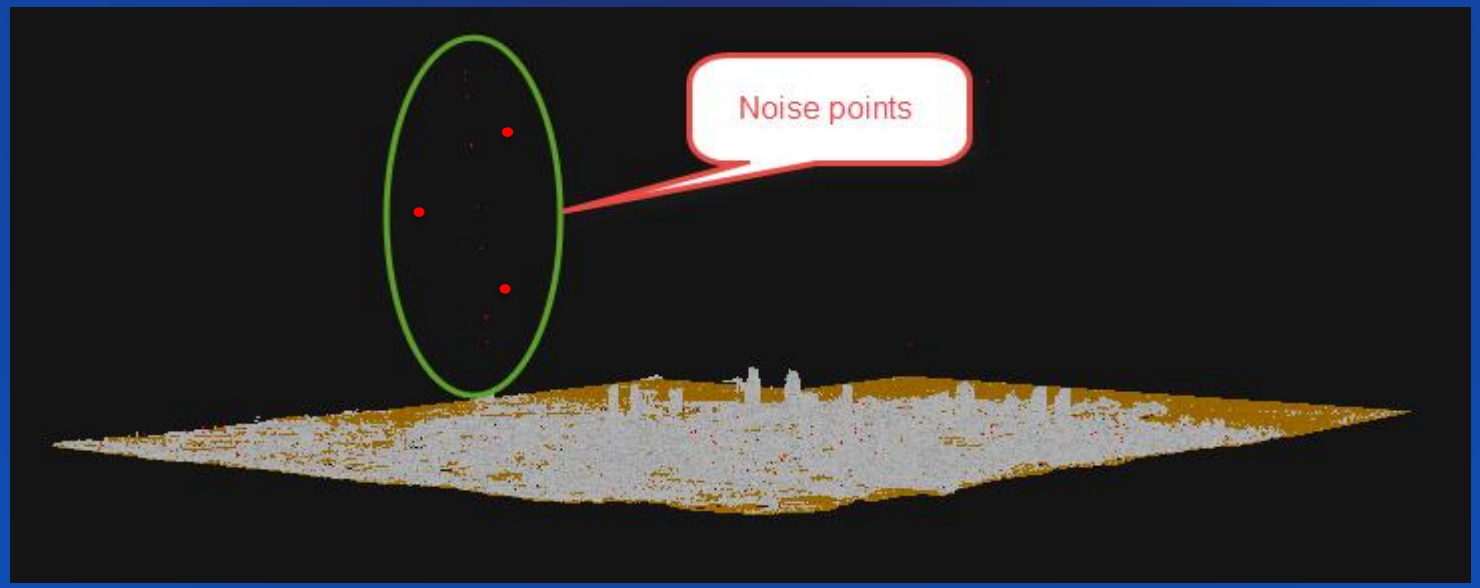
- Geoprocessing tool to assign the overlap flag/code to points in areas of overlap between flight lines.
- Area of overlap introduces high frequency noise to ground which interferes with creation of high quality DEMs. It’s therefore desirable to exclude the overlap.
- Tool helps improve quality of DEMs ArcGIS can produce.

**Overlap in purple**



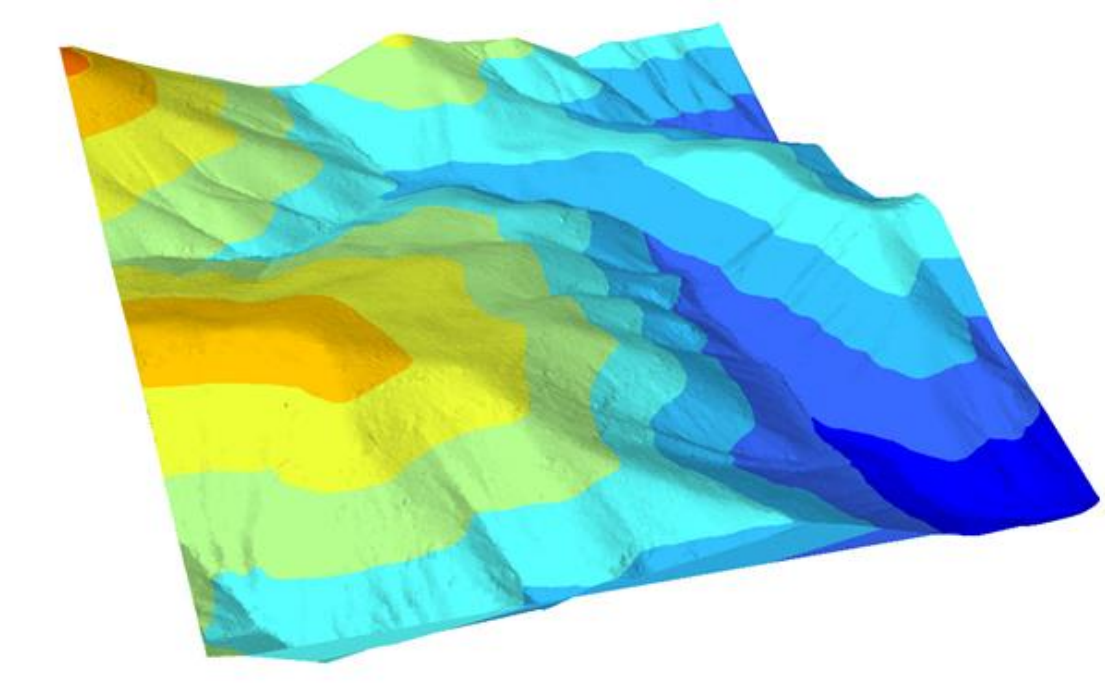
# Classify LAS Noise

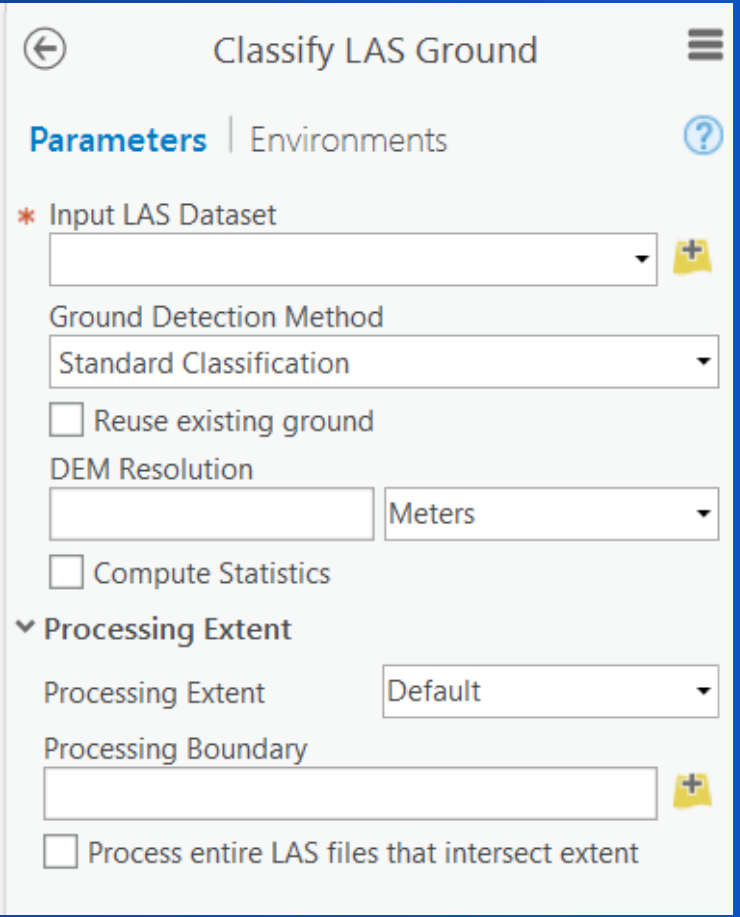
- Tool to classify noise points in lidar.
- Erroneous points are caused by a variety of things such as haze, birds, and water.
- Present at least to some degree in all lidar collections.
- Noise interferes with display and processing of the data.
- This is a fundamental capability.



# Classify LAS ground

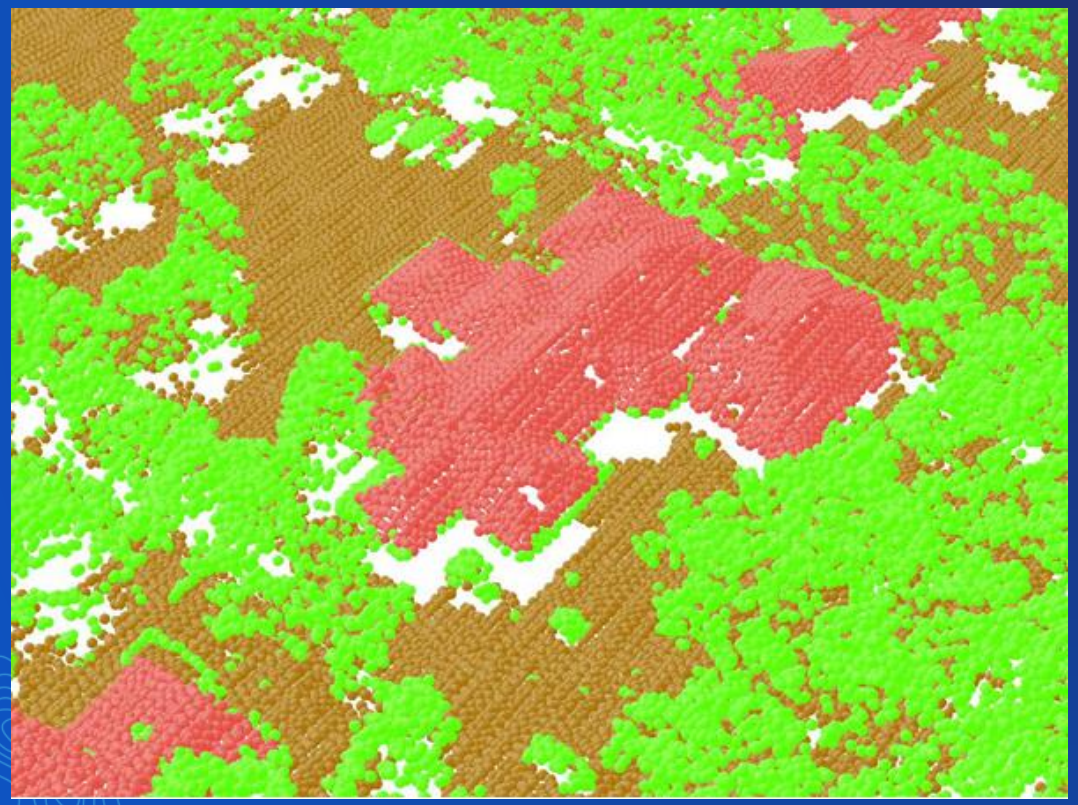
- Classifies ground points in lidar data
- Only the last return of LAS points with class code values of 0, 1, or 2 will be considered for reclassification as ground.

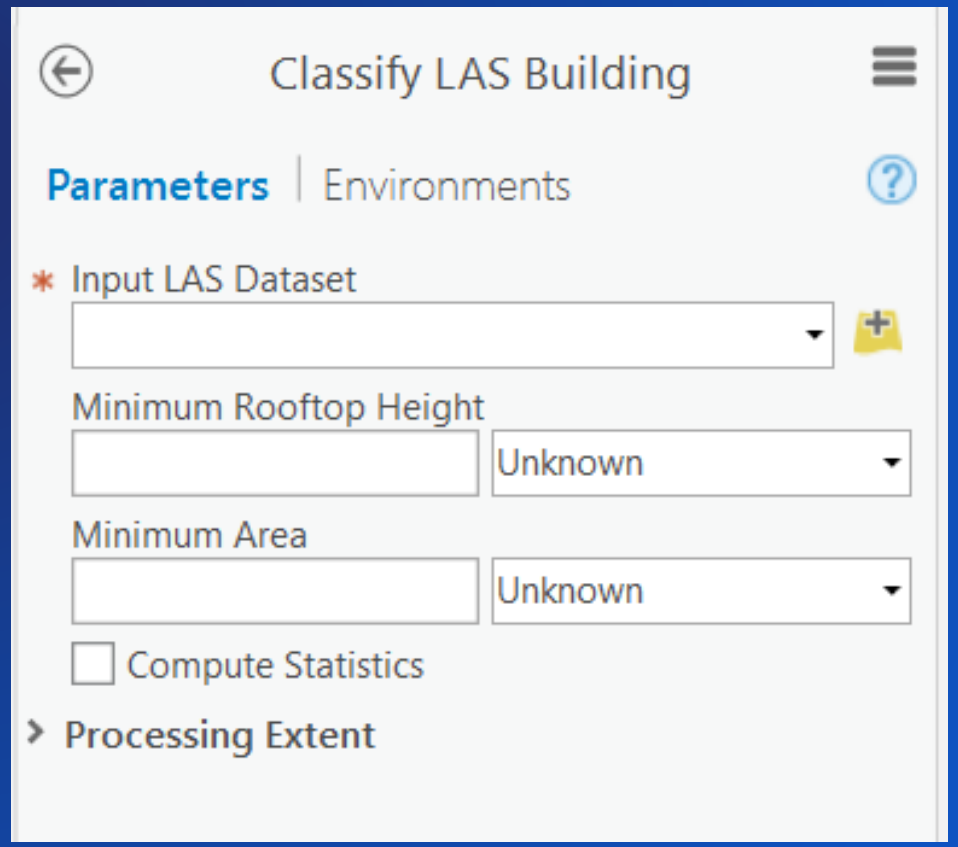




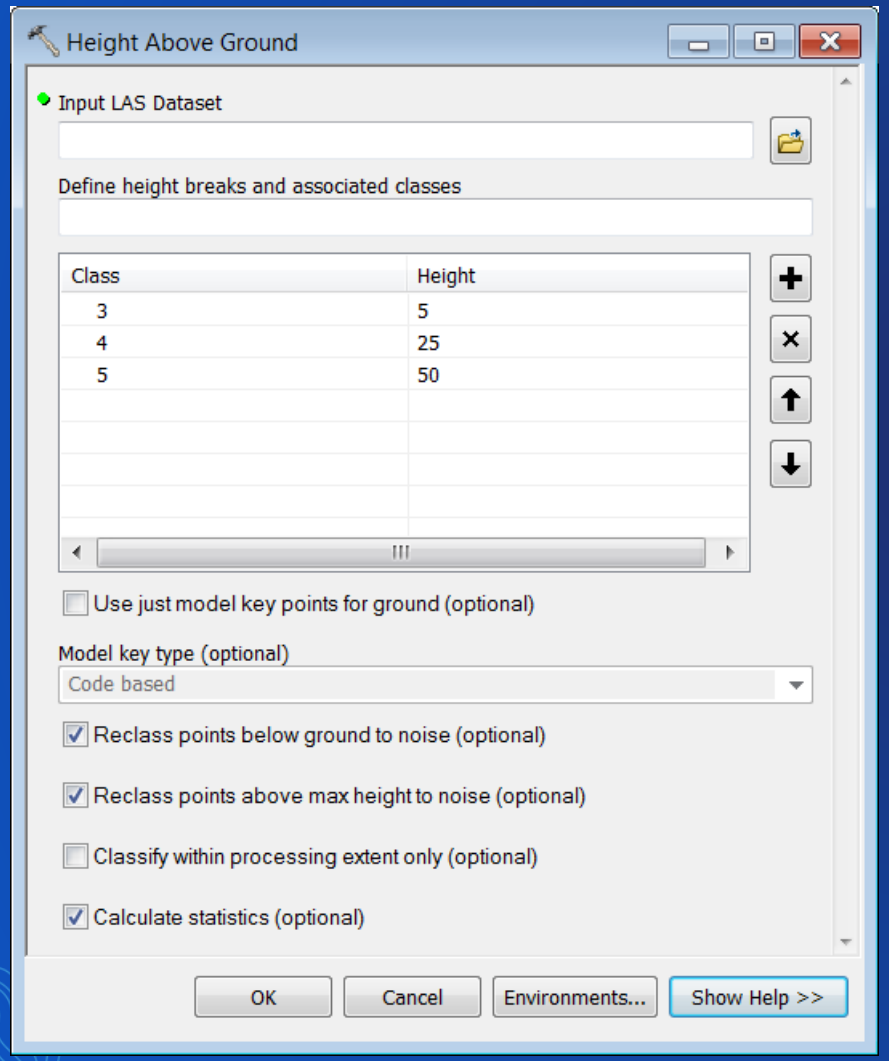
# Classify LAS buildings

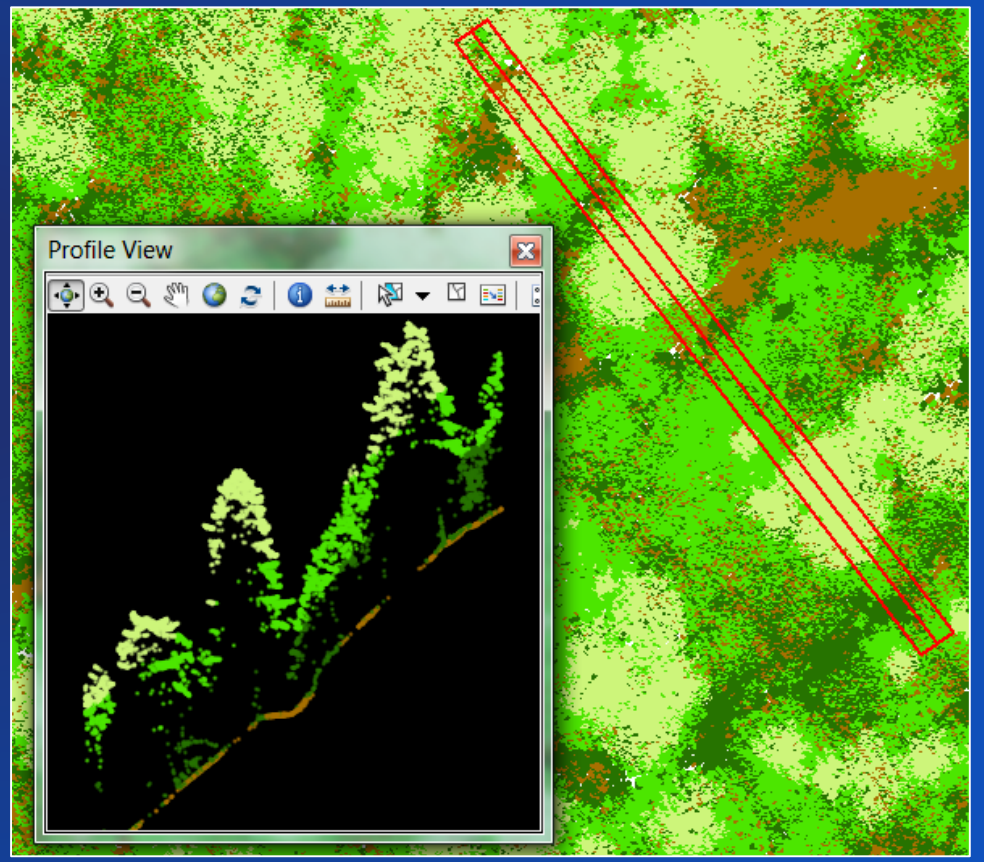
- Classifies building rooftop points in aerial lidar data
- The lidar data must have ground points that are assigned a class code value of 2.





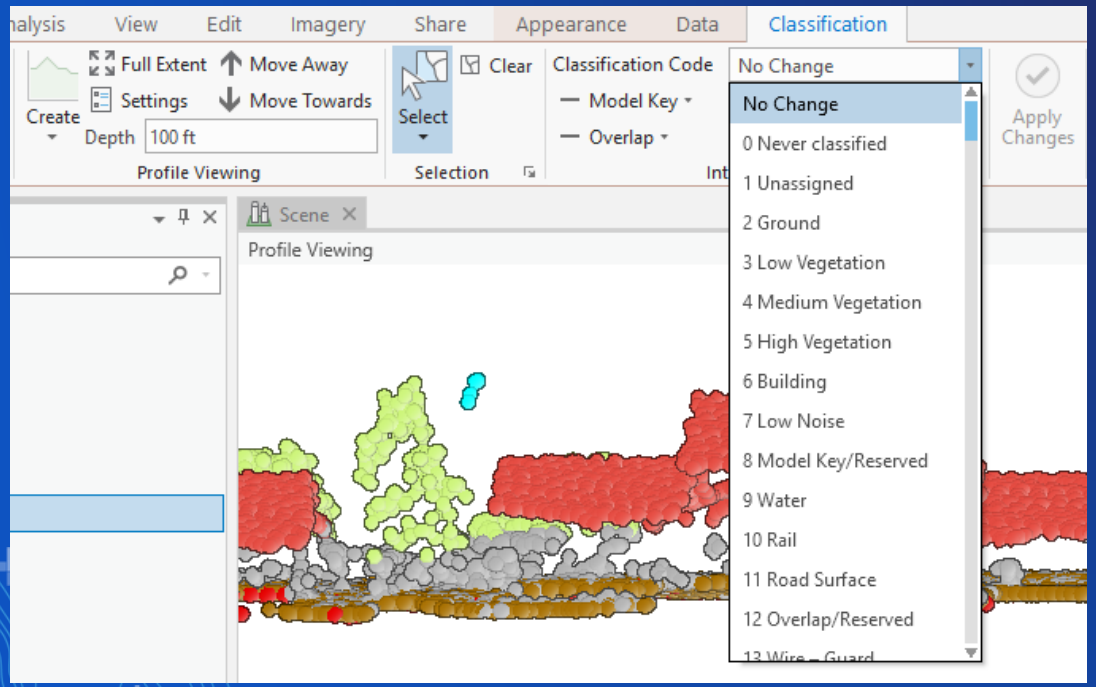
# Classify LAS by Height

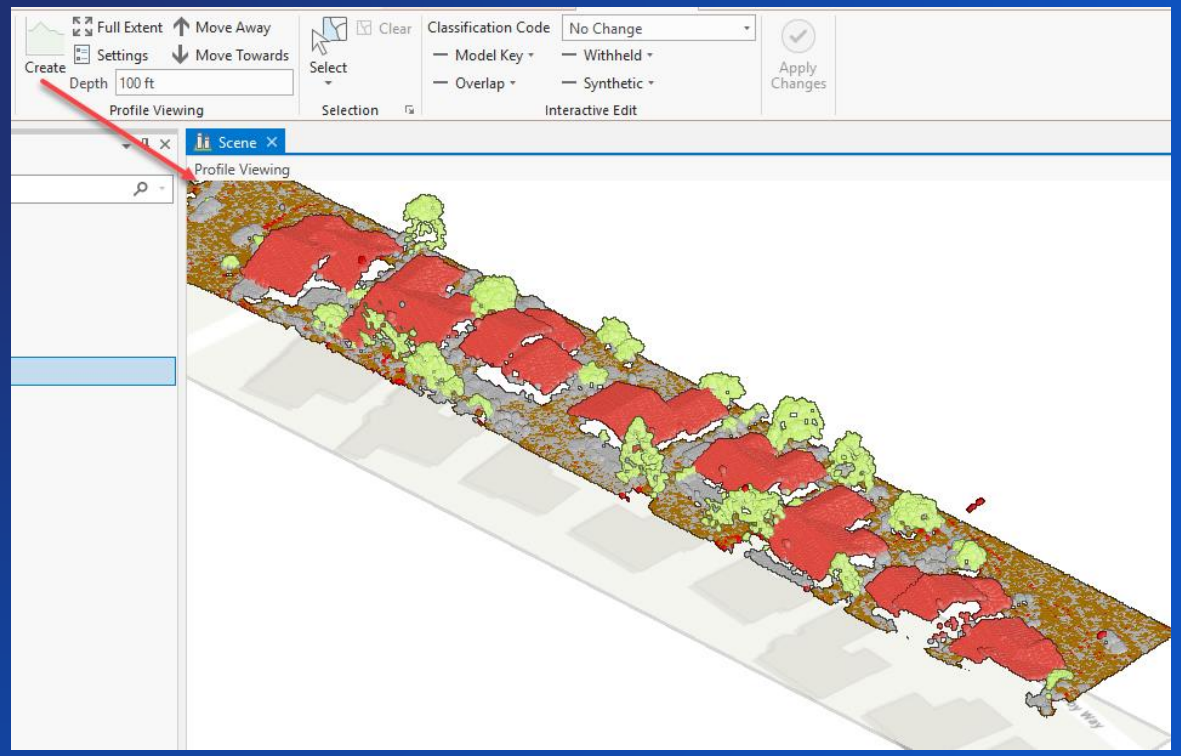


# Profile Viewing: Pro

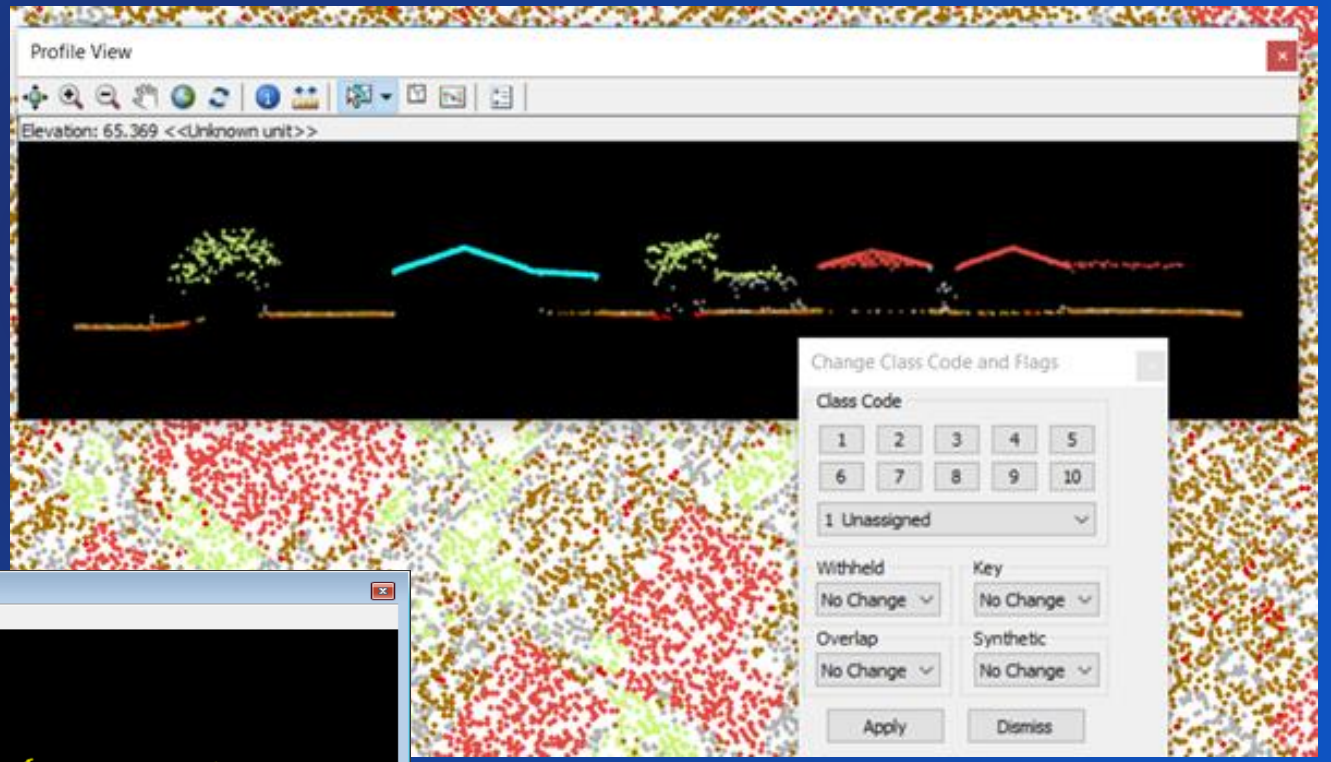
- New for 3D views is the ability to create a profile viewing state.
- For lidar this helps in fixing data anomalies and misclassifications.
- You can interactively add a profile line in the scene, and the view automatically shifts to display a vertical slice of the content.

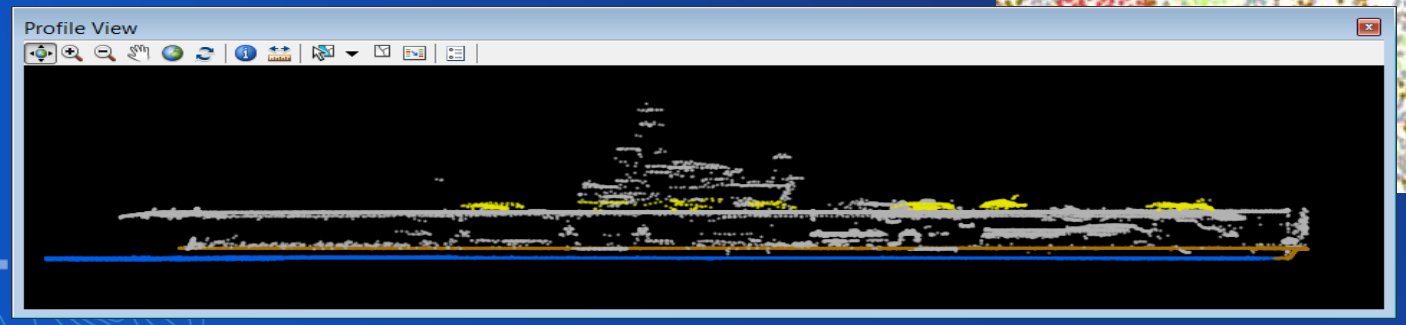


# Profile Viewing: ArcMap

- Fixing data anomalies and misclassifications via point profile window

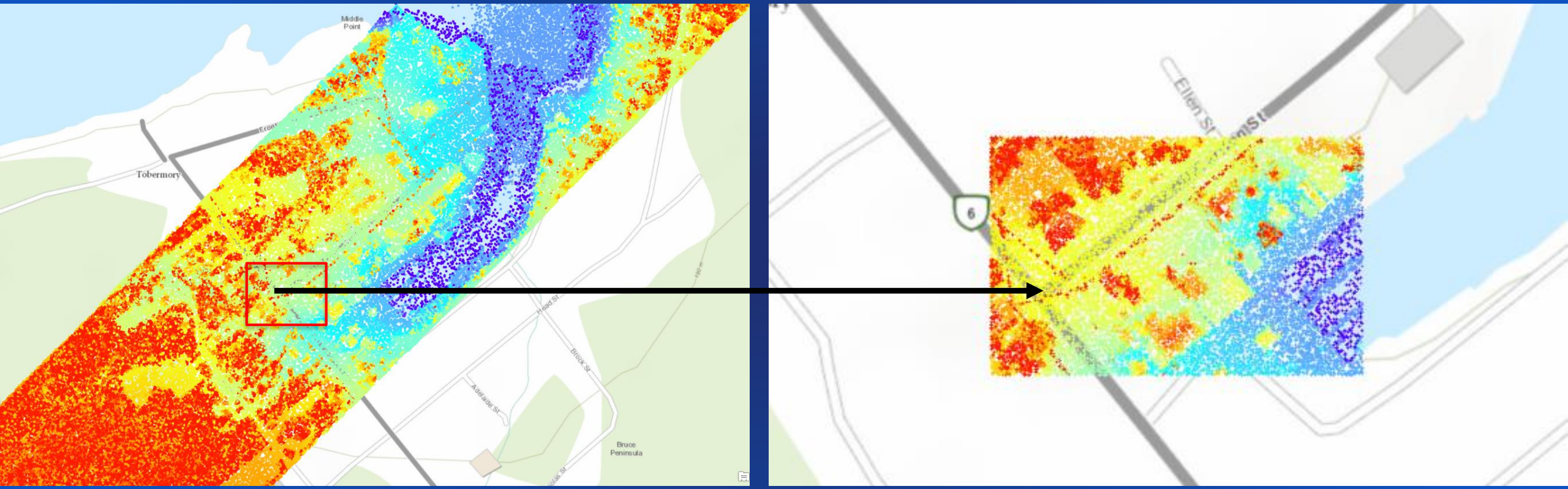


# Colorize LAS

- Applies colors and near-infrared values from orthographic imagery to LAS points.
- Displaying LAS points using RGB information can provide a photorealistic display that delivers a unique display experience.

# Extract LAS



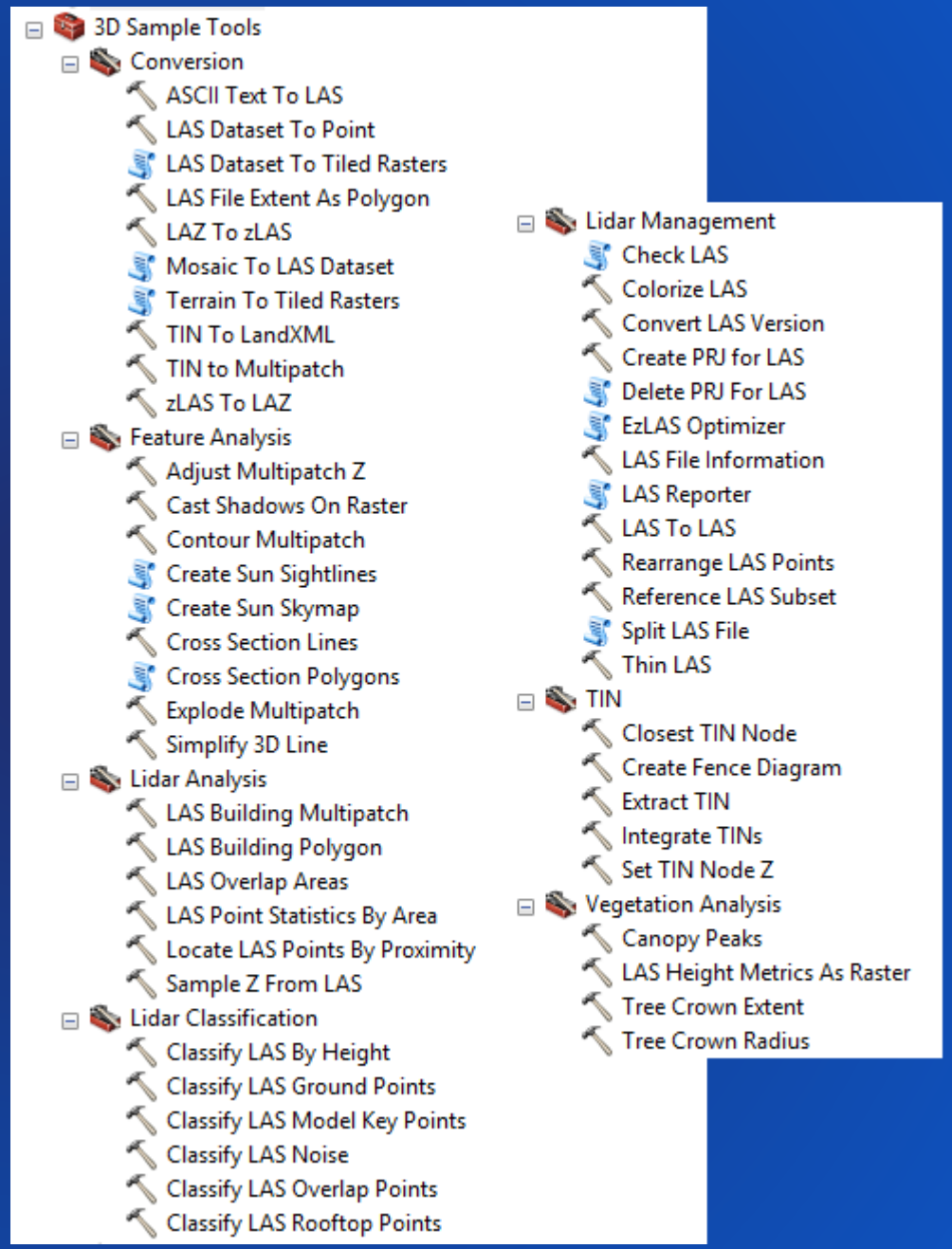

Data courtesy of Optech

# Point Cloud Classification

Lindsay Weitz

# Lidar/3D Sample Tools

- Available in ArcGIS 10.2 – 10.7
- Sample geoprocessing tools
  - http://links.esri.com/3dSamples



# What Do We Mean by “Feature Extraction”?

- Using analytical methods to identify geographic features from remote sensing data
- Different types of remote sensing data can be used in conjunction to identify features
- Extracted features can be points, lines, polygons, or volumes (i.e. multipatches)

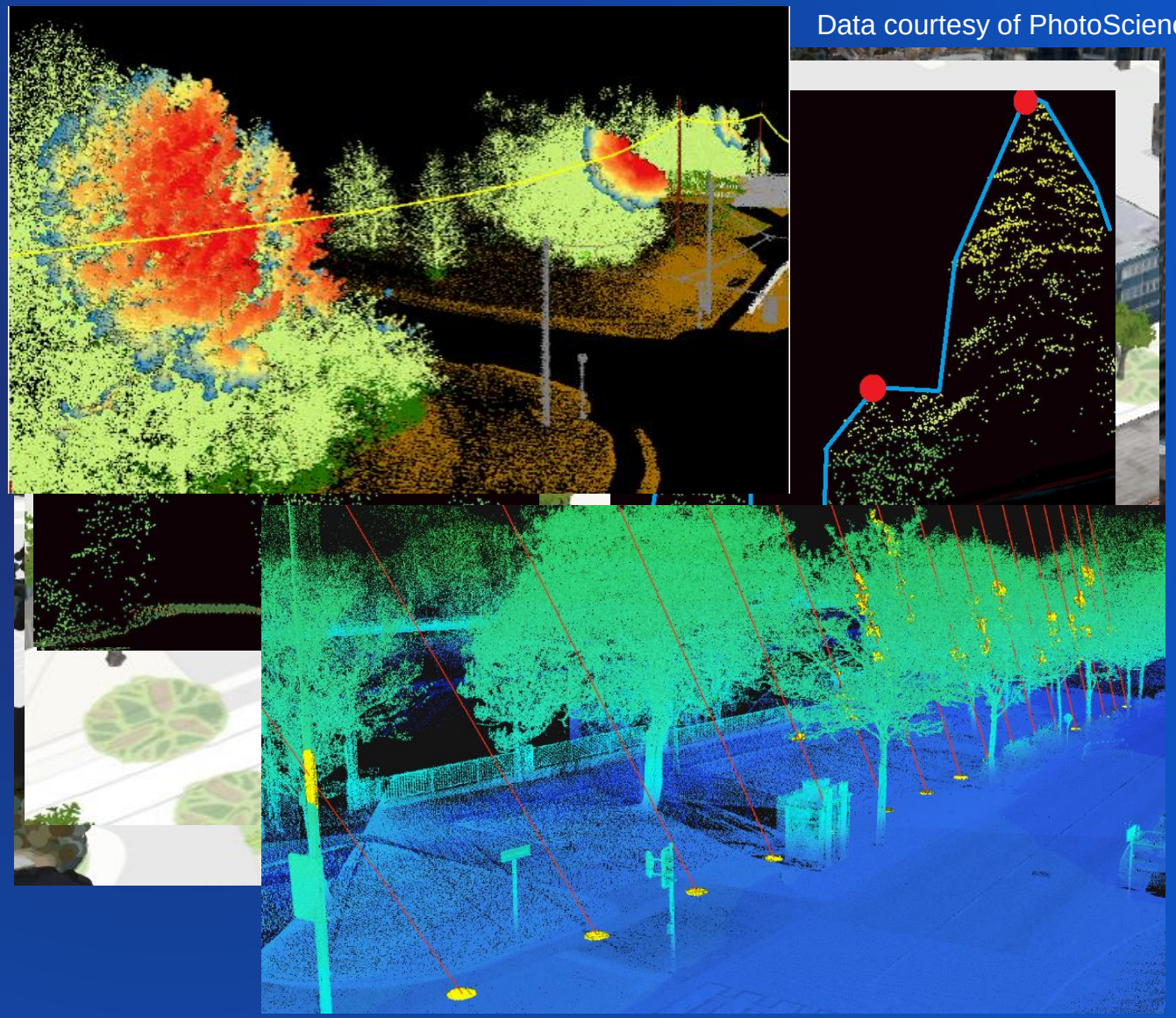
# Feature Extraction Examples - Points

## LAS Points as features

- Points within proximity of features
  - Locate LAS Points by Proximity
- Colorized Vegetation
  - Colorize LAS

## Derived Points

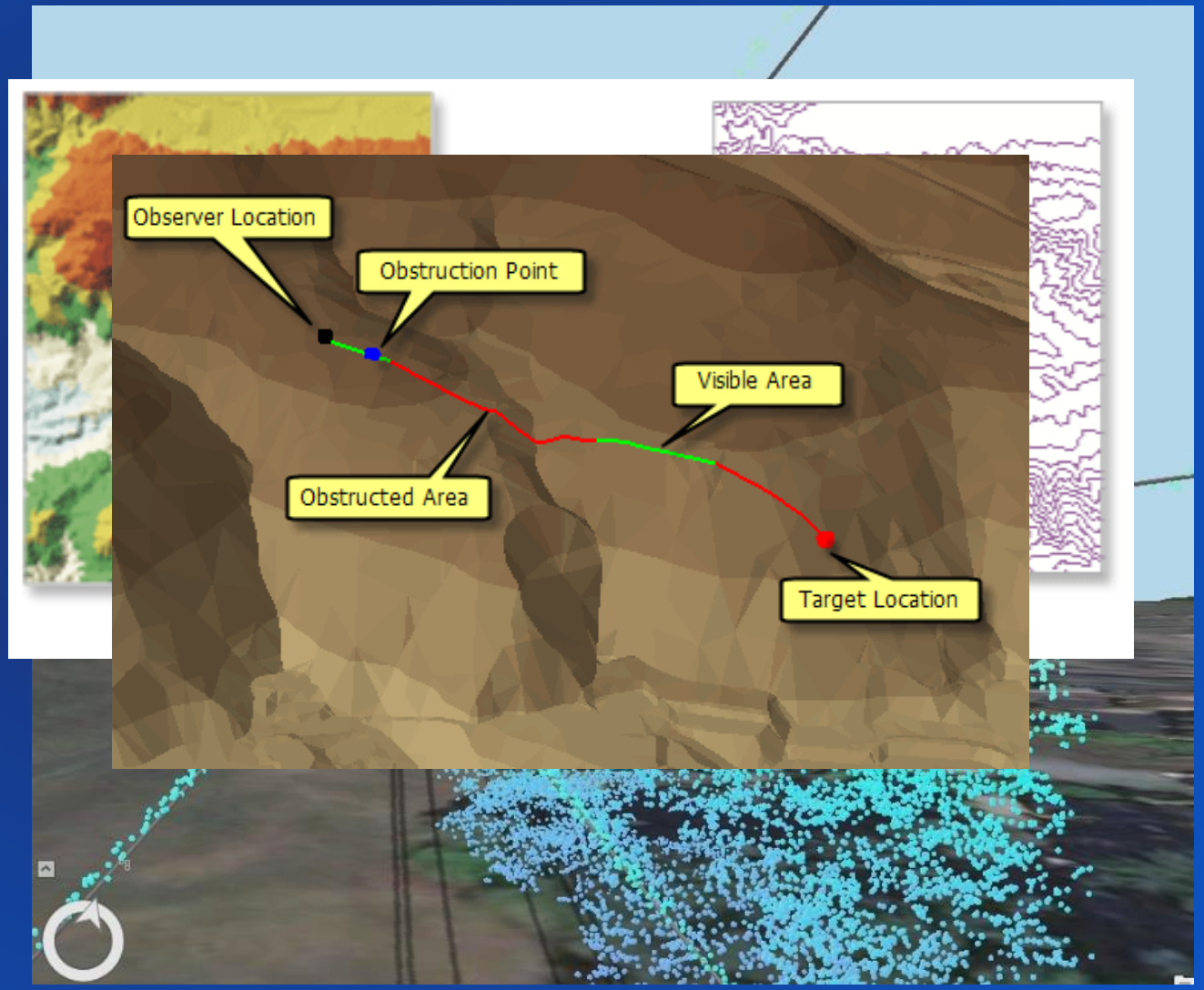
- Tree Crown Points
  - Flow Accumulation on inverted DSM
  - NDVI ensures only vegetation captured
  - Procedural 3D tree symbol



Data courtesy of PhotoScience

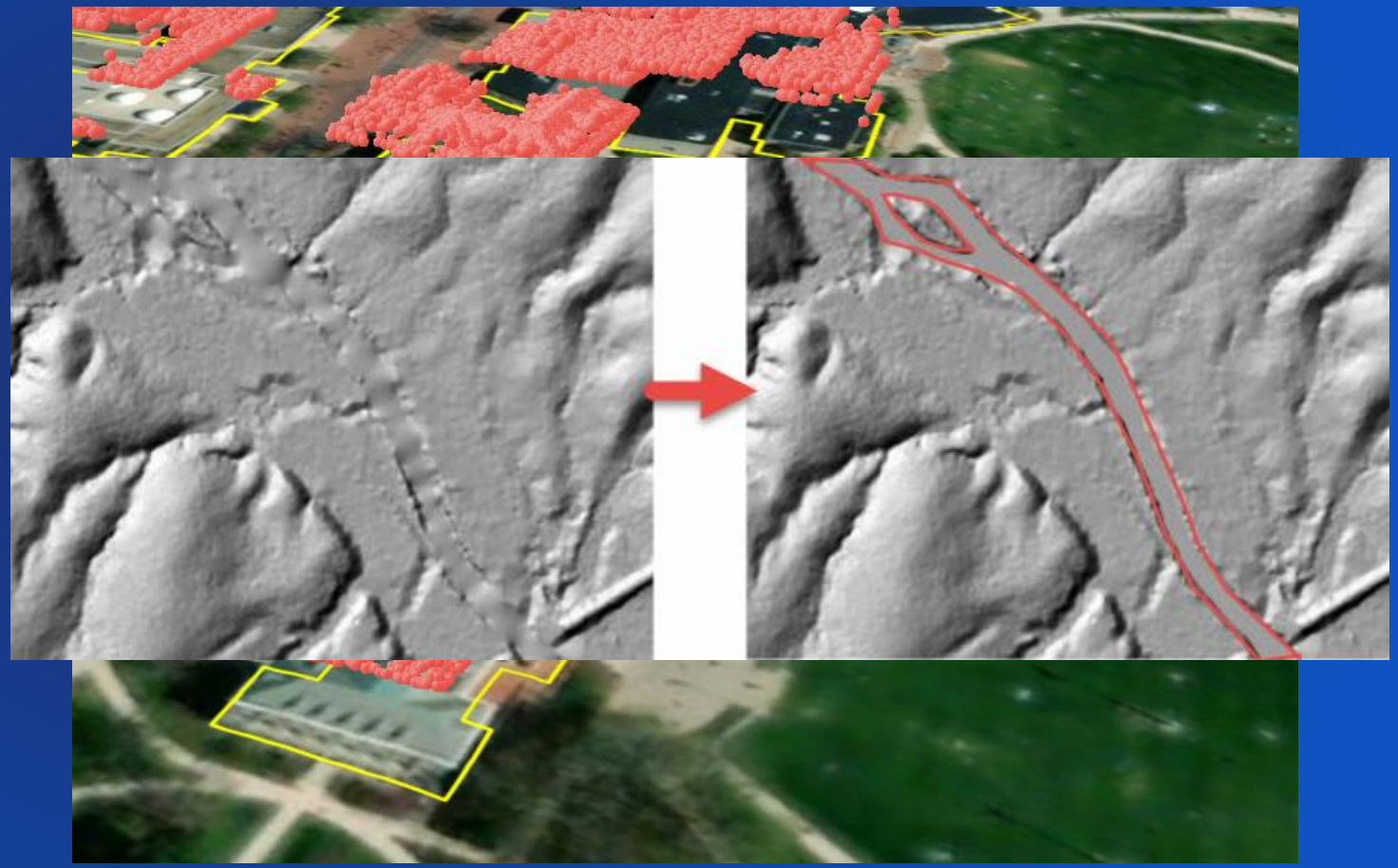
# Feature Extraction Examples - Lines

- Contours
  - Contour tool
- Lines of Sight
  - Line of sight tool
- Powerline Catenaries
  - Solution under development



# Feature Extraction Examples - Polygons

- Building Footprints
  - LAS Point Statistics as Raster (Predominant Class)
  - Raster to Polygon
  - Regularize Building Footprint
- Water bodies
  - LAS Point Statistics as Raster (Point Count)
  - Raster Calculator (value < threshold)
  - Raster to Polygon
  - Select large polygons
  - Set LAS Class Codes Using Features



# Feature Extraction Examples - Volumes

## 3D Buildings

- Procedurally created using roof form values extracted from LiDAR
  - Local Government 3D Basemap Solution
- Direct TIN representation of building LAS points
  - LAS Building Multipatch

# Extracting 3D Buildings from Classified LiDAR

Dan Hedges

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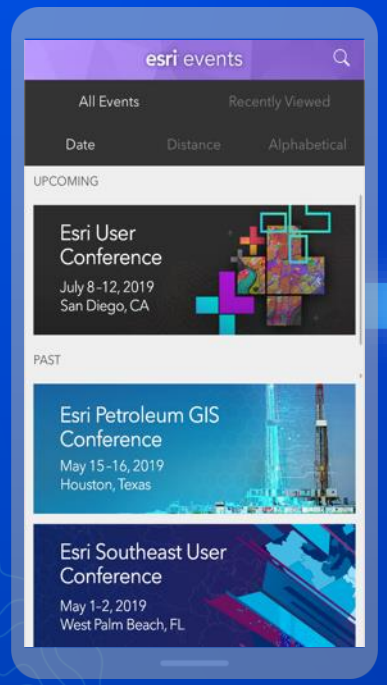
Download the Esri Events app and find your event

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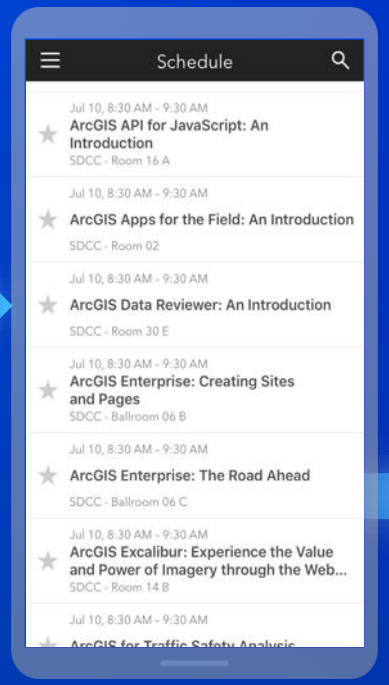
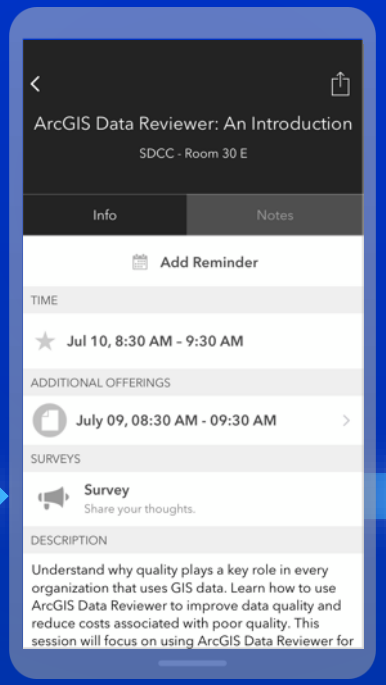
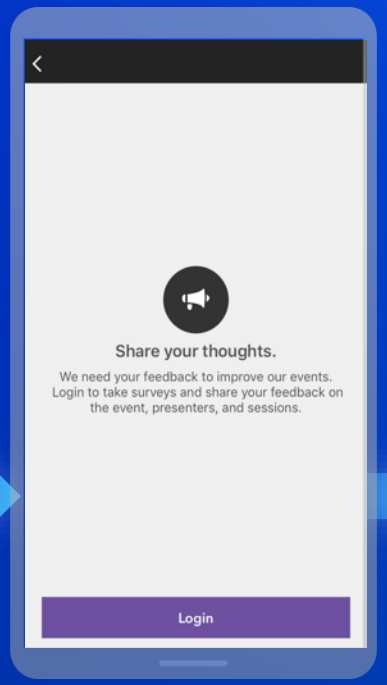


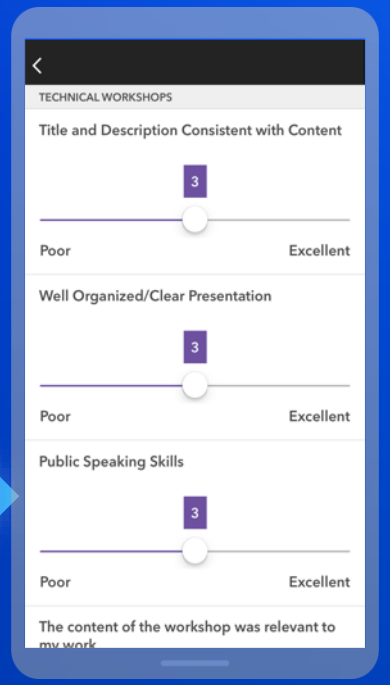

Scroll down to "Survey"




Log in to access the survey




Complete the survey and select "Submit"

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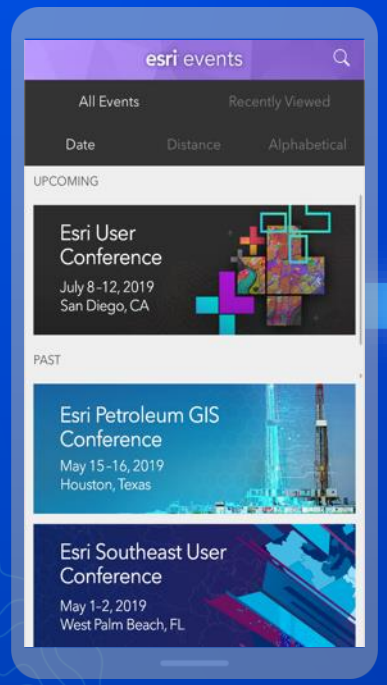


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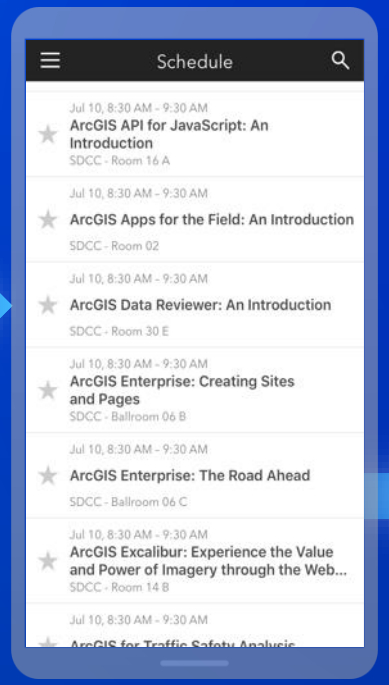


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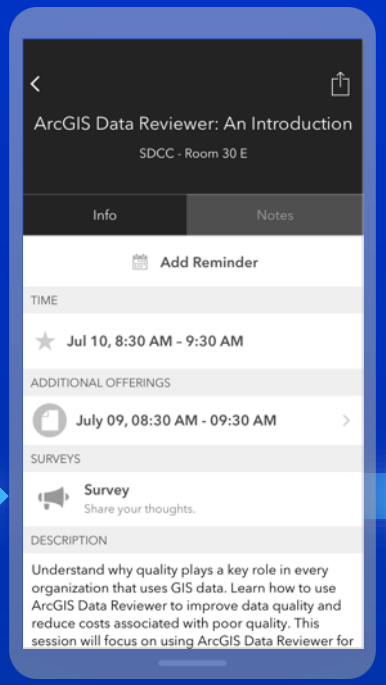


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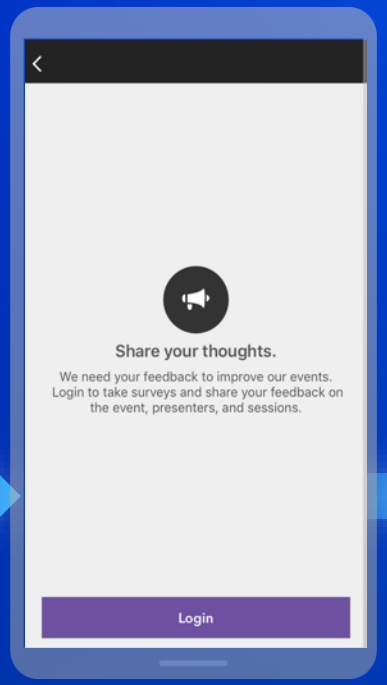


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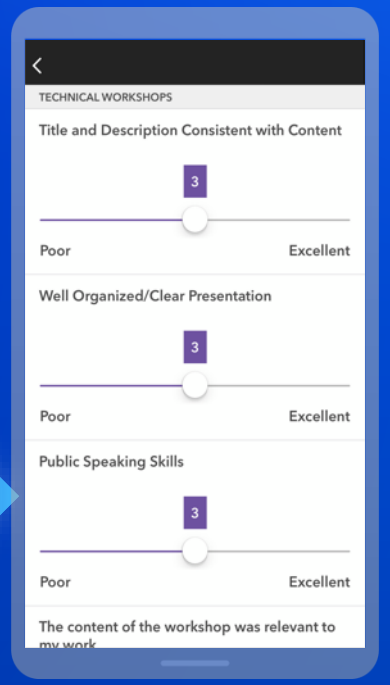

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