Survey to Support 2D Hydraulic Aquatic Habitat Models

New Mexico Interstate Stream Commission (NMISC)

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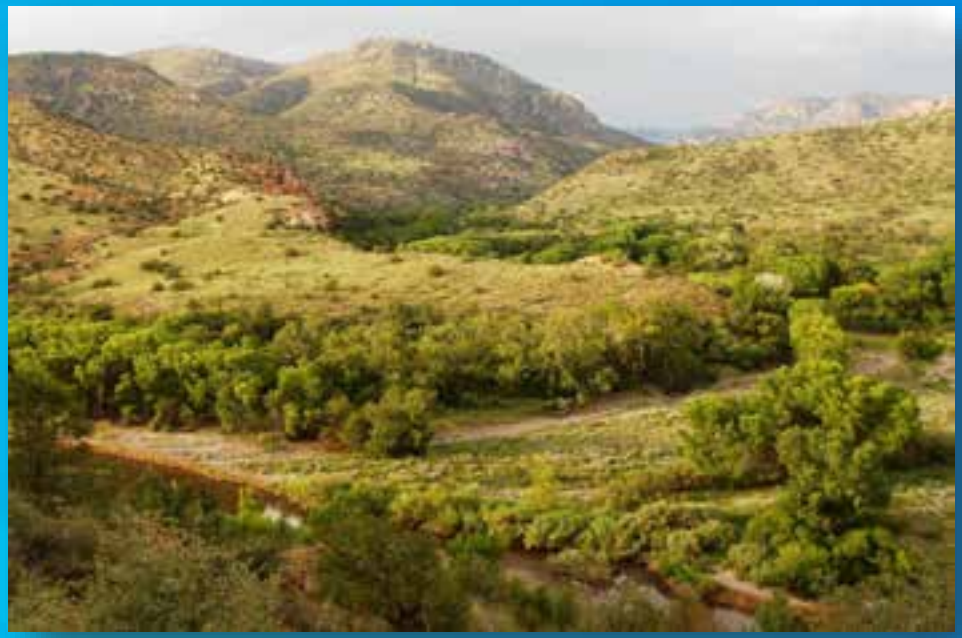
Gila River Fish Habitat Study - 2014

Objectives

- **Determine potential change in fish habitat resulting from proposed AWSA[1] diversions in the Study Area**
  - **Existing agriculture diversions (earthen berms pushed up with a bulldozer)**
  - **Proposed AWSA diversion and storage**
  - **Release of “ecological” augmentation flows**



1. Arizona Water Settlements Act

Focus Species

Native and Non-Native Federally Endangered Species

- Loach Minnow
- (*Tiaroga cobitis)*

- Spikedace
- (*Meda fulgida)*

- Native Species Assemblage

- Non-Native Species Assemblage

How to evaluate fish habitat?

Hydraulic Model!

- 1D and 2D models available
- Technology is making 2D models cost effective
- River2D Habitat Model

Study Design - Reach Designation

- Turkey Creek (2,600 ft long-1,200,000 sq ft)
- Mogollon Creek (650 ft long-140,000 sq ft)
- Fort West (1,500 ft long-400,000 sq ft)
- Gila Farms (800 ft long-115,000 sq ft)

Model Quality is Driven by Accurate Topography

Data collected in field using modern survey techniques

2D Model – Survey Technology

Robotic Total Station (RTS)

Real Time Kinematic (RTK) GPS

Aerial LiDAR

Terrestrial LiDAR (Laser Scanning)

Robotic Total Station (RTS)

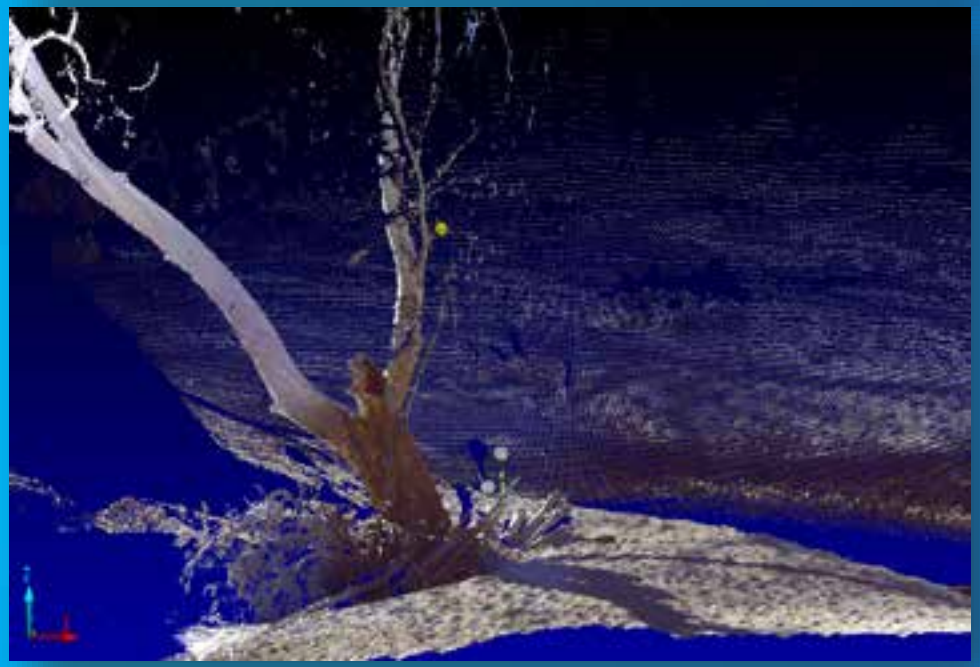
- Survey Instrument That Can Track Survey Rod and Automatically Calculate Angles and Distances
- Collects XYZ Location As Fast As Field Staff Can Move The Sensor and Hold It Still Again
- Setup More Time Consuming Than RTK
- Requires Existing Control or Static Survey Grade GPS to Place in Geographic Coordinate System
- Accurate to 0.14 cm

Real Time Kinematic GPS (RTK)

- GPS Sensor Accepting Real Time Corrections From Static GPS Base Receiver
- Collects XYZ Location As Fast As Field Staff Can Move The Sensor and Hold It Still Again
- Minimal Processing
- Accurate From 1-5 cm or Less

Terrestrial LiDAR

- Survey Instrument That Can Collect Dense Point Clouds From Stationary Position
- Collects XYZ Locations and RGB Values for Each Return
- Does Not Penetrate Vegetation
- Requires Existing Control or Static Survey Grade GPS to Place in Geographic Coordinate System
- Highly Accurate, Very Dense



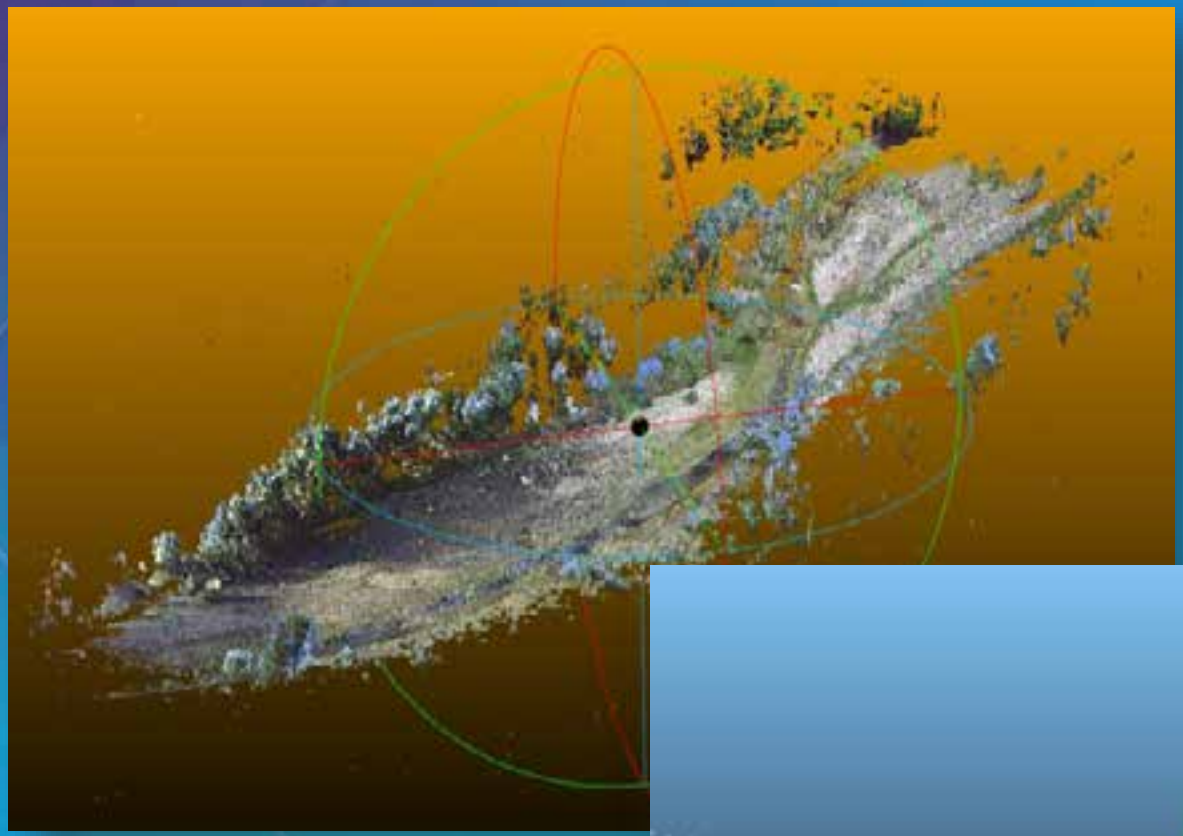
Aerial LiDAR

- Sensor Collects Point Cloud From Airplane or Helicopter
- Collects XYZ Locations Along Swath
- Penetrates Canopy
- Collects Large Area Topography and Canopy/Structure Data Quickly
- Accuracy Varies Depending On Sensor and Platform

Study Design - Reach Designation

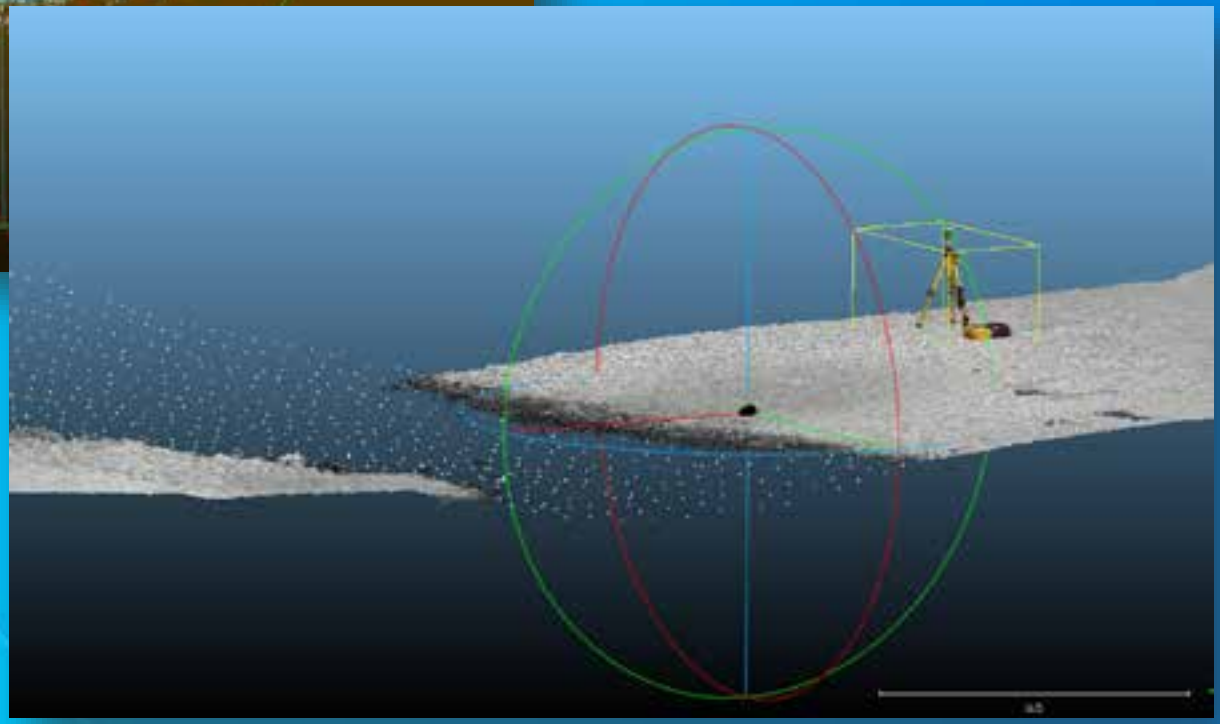
- Turkey Creek
  - LiDAR
  - RTK
  - RTS
- Mogollon Creek
  - LiDAR
  - RTK
  - RTS
  - Laser Scan
- Fort West
  - RTK
  - RTS
  - Laser Scan
- Gila Farms
  - RTK
  - RTS
  - Laser Scan

Laser Scan



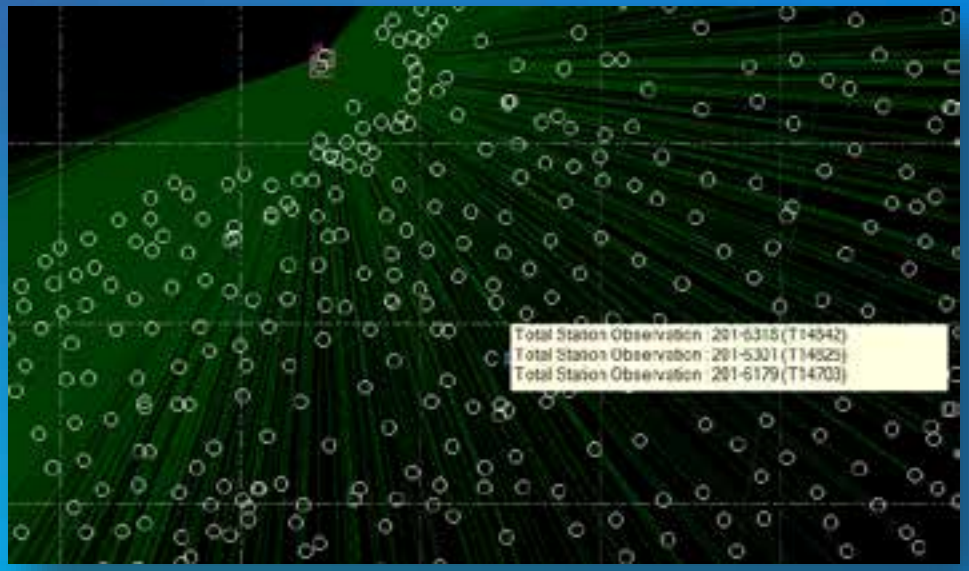
Dense scan data reduced using open source software Cloud Compare

Exported to GIS feature class



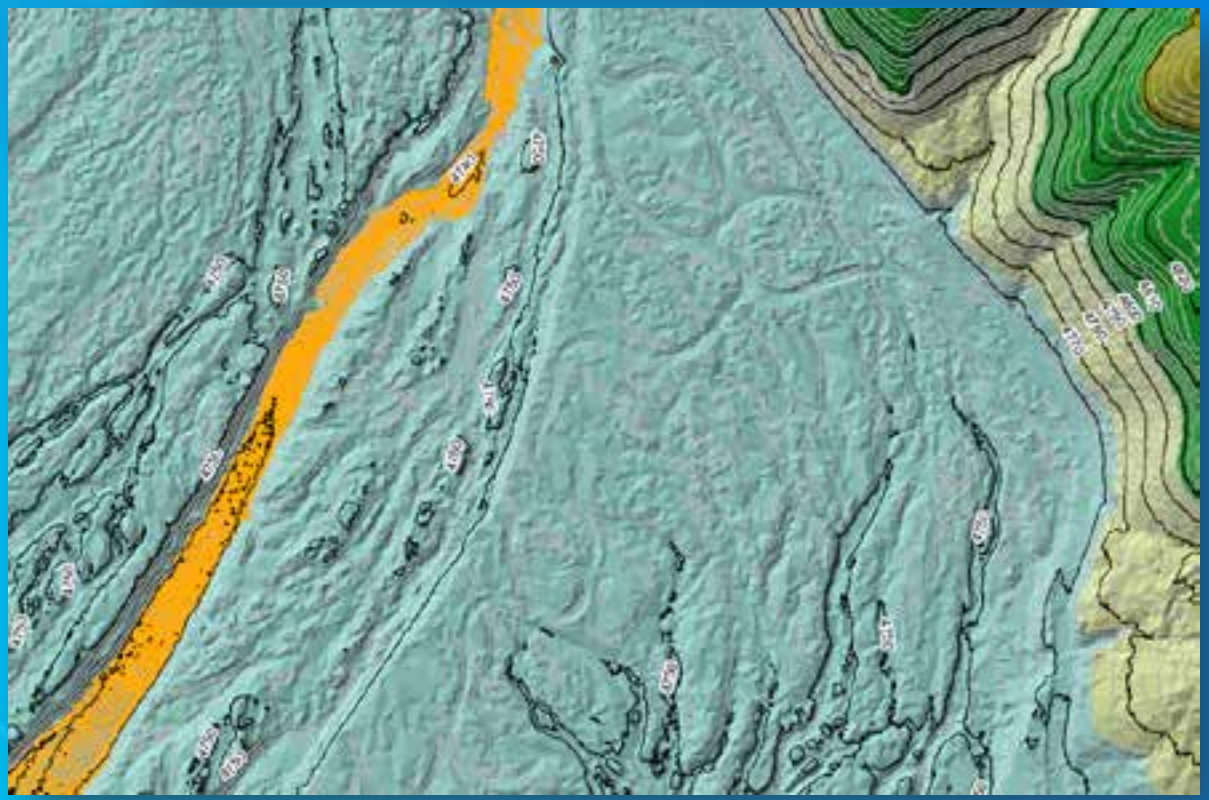
RTK and RTS

- OPUS Correction for RTK
- Transformation to common survey points for RTS data
- Positions corrected using Trimble Business Center
- Points Exported to GIS feature class



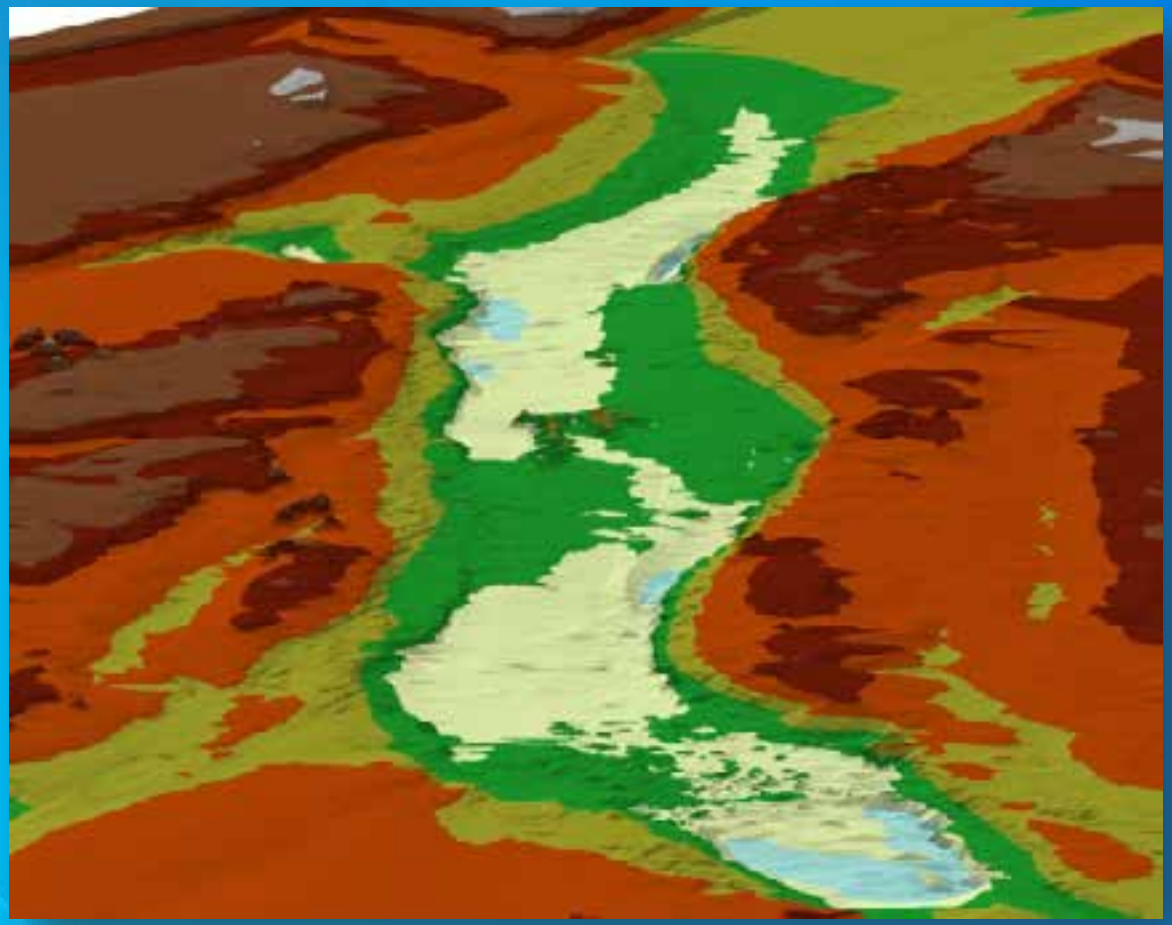
Aerial LiDAR

- Reduced using ArcGIS terrain pyramids
- Points exported to GIS feature class



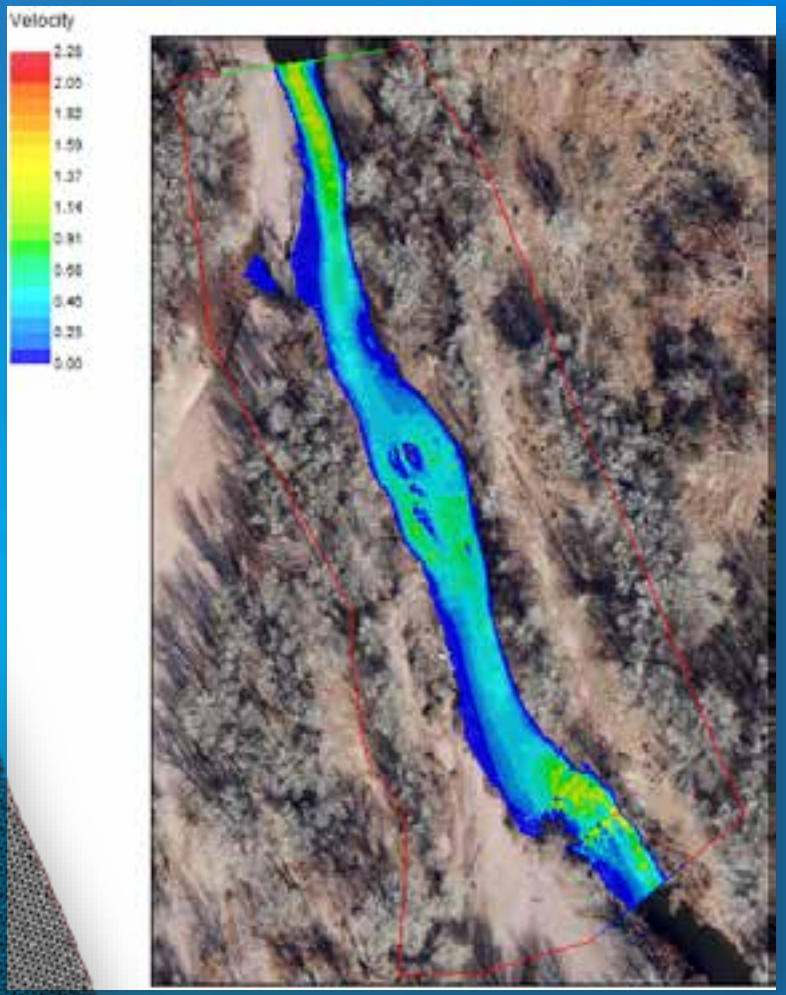
Point Data Processed and Merged

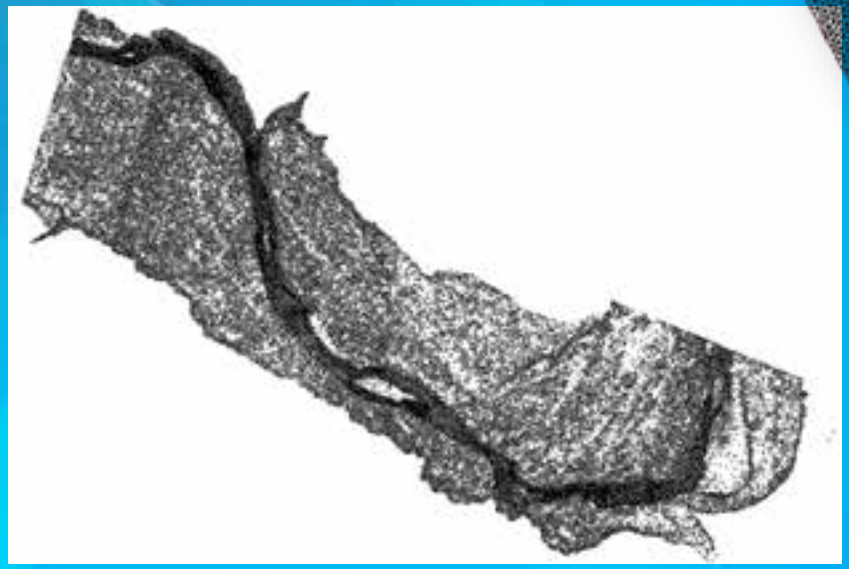
- Online Positioning User Service (OPUS) Correction for RTK
- Transformation to common survey points for RTS data
- Positions corrected using Trimble Business Center
- Points Exported to GIS
- QC completed in ArcScene
- Exported to River2D

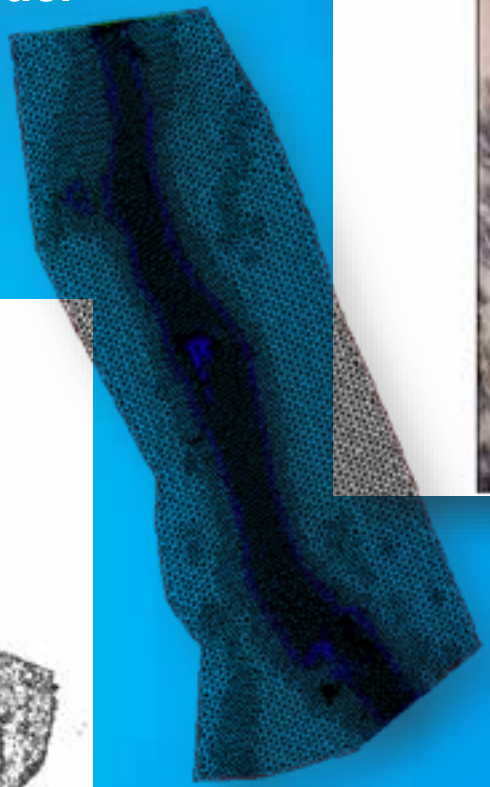


Final Surfaces

- Exported to River2D compatible text file format using Python
- XYZ Point file
- Surface used as base for mesh development and hydraulic model







Habitat Modeling

River2D Spatial Output

Turkey Creek Study Site - Loach Minnow Adult – 65 cfs

Summary

- Objective – Evaluate fish habitat on Gila River
- 2D Model River2D requires dense, accurate topography
- Cost effective modern survey methods used to collect data
  - Merged LiDAR, RTK, RTS, and Laser Scan
- Final topographic data used develop robust and effective 2D fish habitat model

Questions?

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