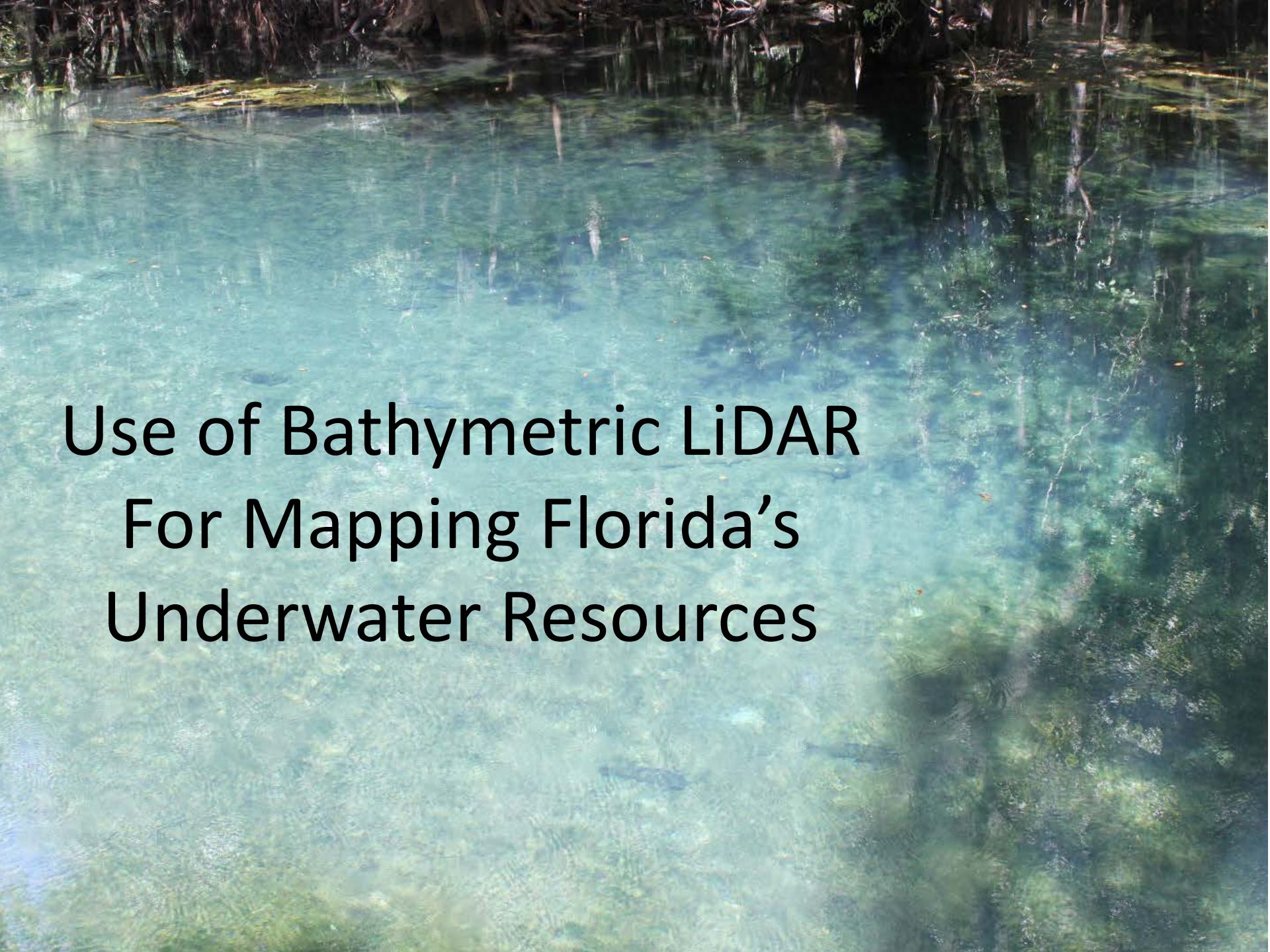


Use of Bathymetric LiDAR For Mapping Florida's Underwater Resources

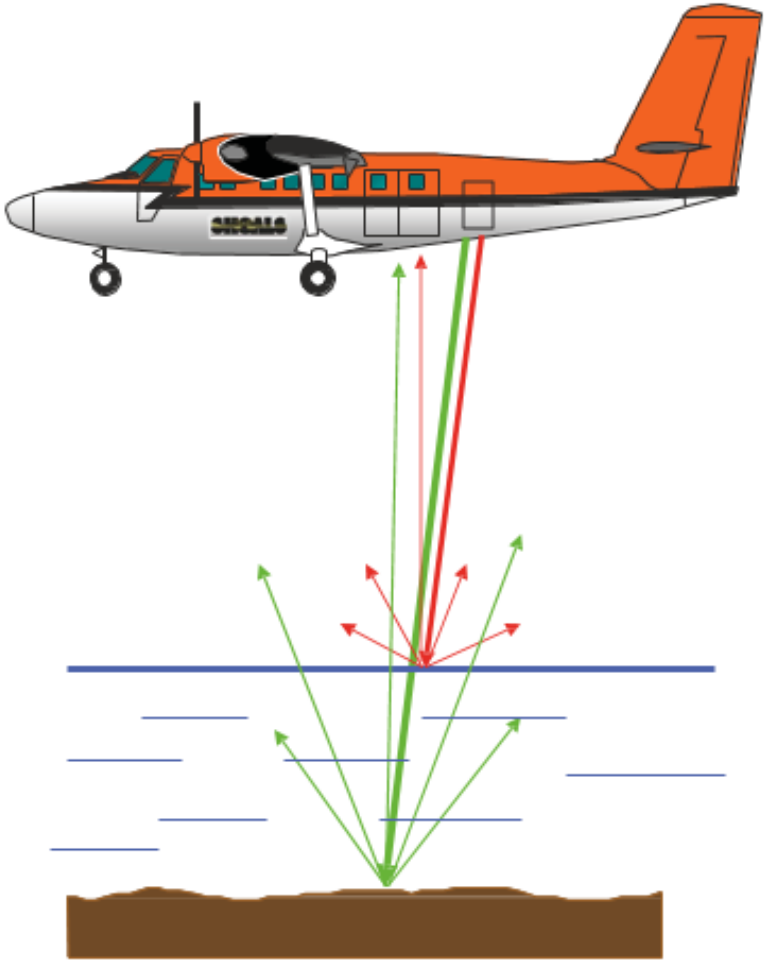
Airborne LiDAR

- Airborne LiDAR (Light Detection And Ranging) is the process of using a laser to measure distances to specific points from an airborne platform.

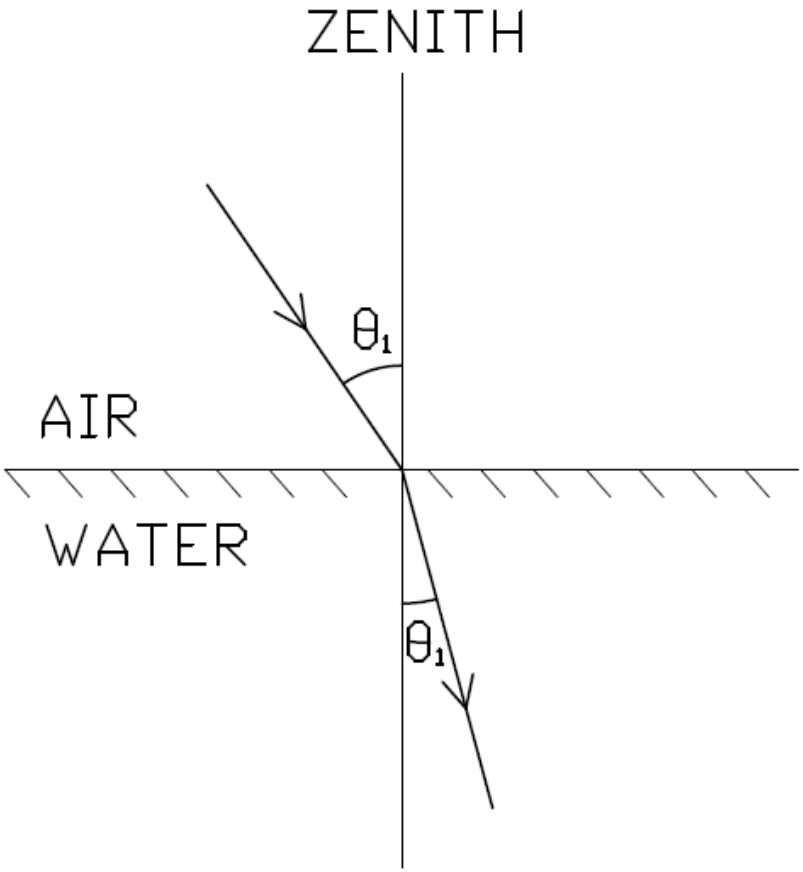
Green LiDAR

- Terrestrial Airborne LiDAR uses red (high frequency wave length-1064 nm) laser.
- Red lasers reflect off of water surface
- Green (low frequency wave length – 532 nm) lasers penetrate water and can be used to map underwater terrain

Green laser pulses (532 nm) reflected from bottom Infrared laser pulses (1064 nm) reflected from water surface



LiDAR Bathymetry Necessary to Correct for Refraction



Recent Tests of Bathymetric LiDAR

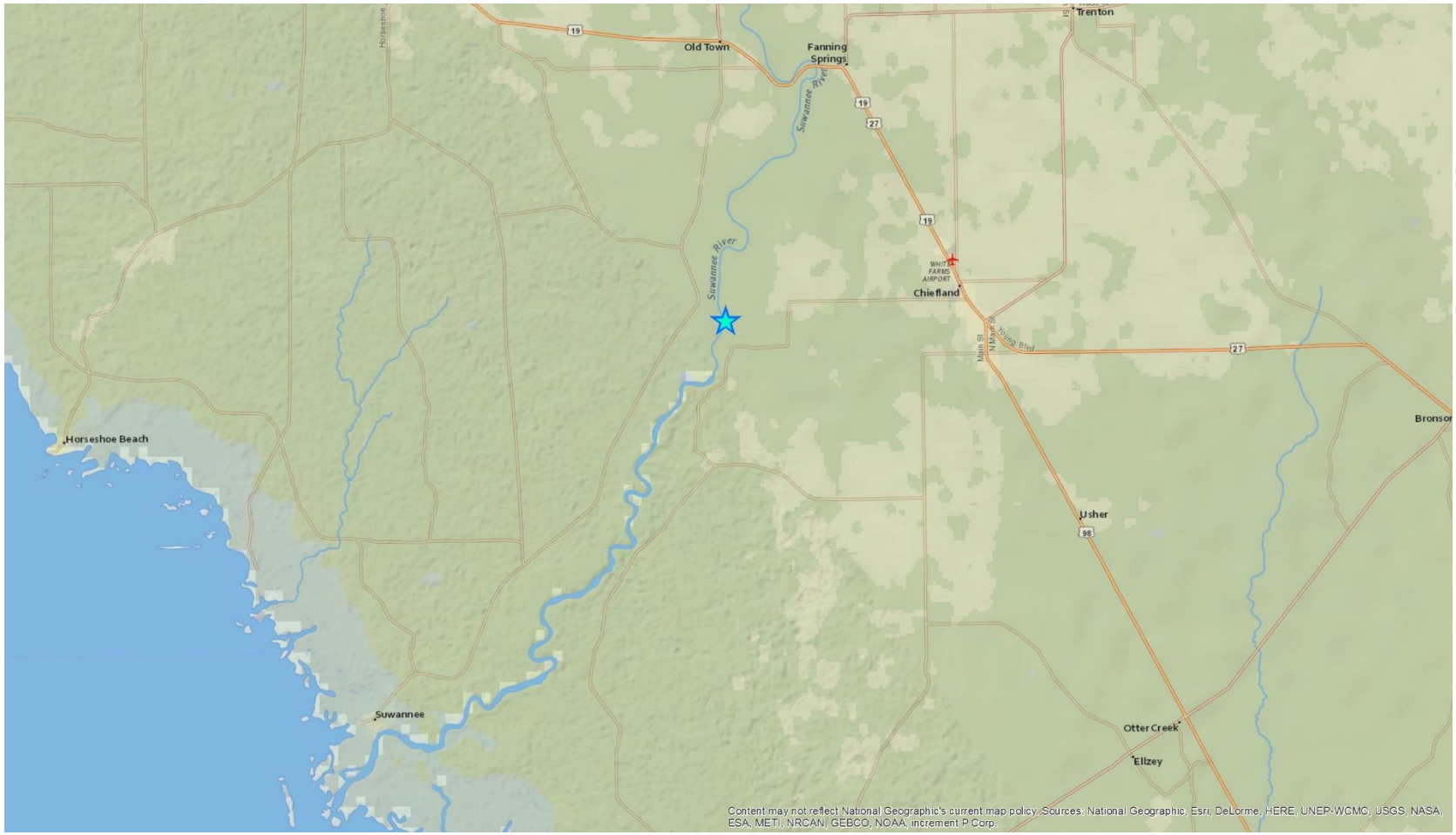
I. Manatee Springs Test

- Conducted by SRWMD
- Area selected to provided good test of process over spring with overhanging tree cover and out into the Suwannee River

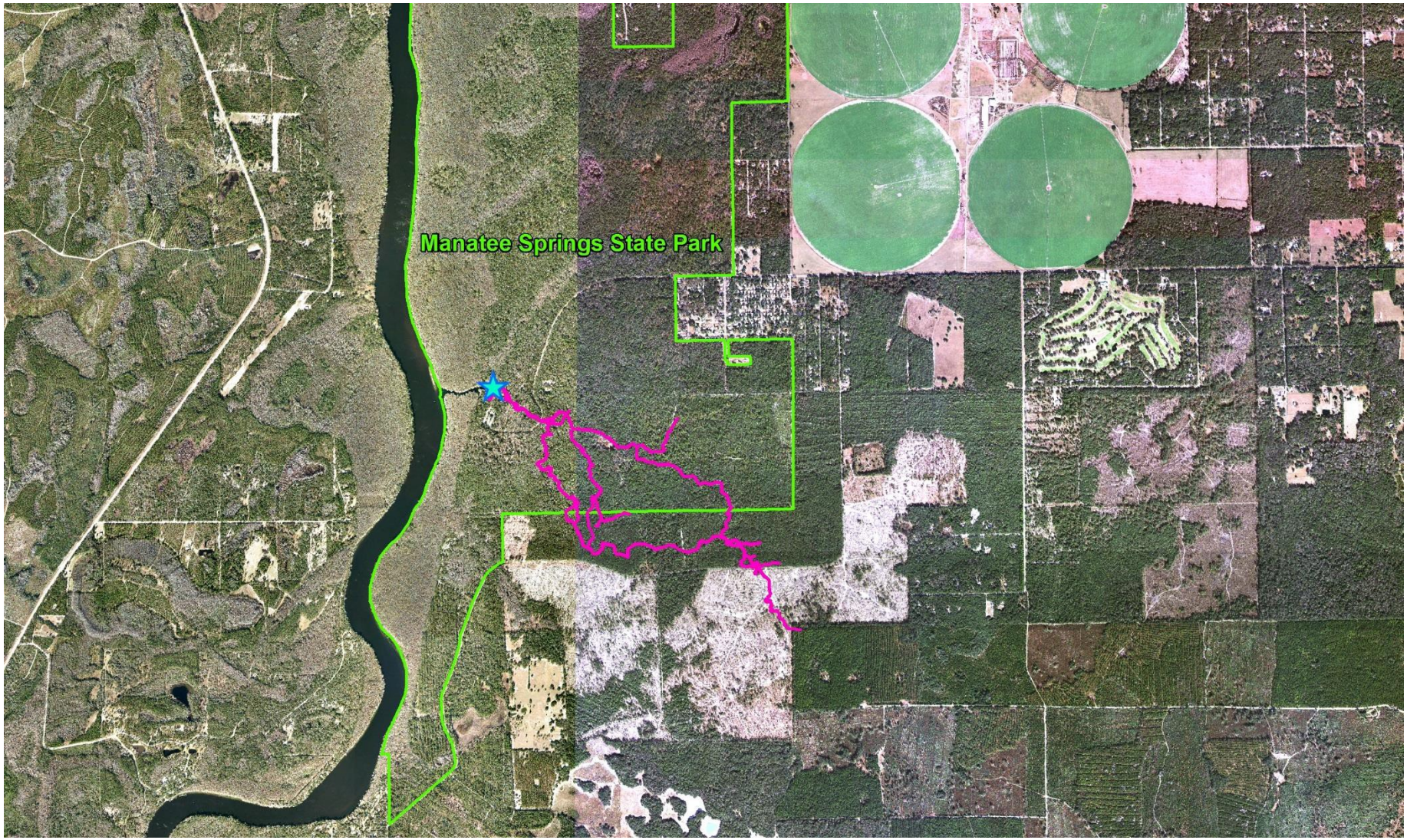
Test Information

- Used Riegl VQ-820-G bathymetric LiDAR flown by Aerial Cartographics of America
- Rated penetration of about 1 Secchi depth up to 10 meters
- Data acquisition flown at 550 m AGL for density of 2 pts/m2

Manatee Springs



Manatee Springs State Park



Manatee Springs

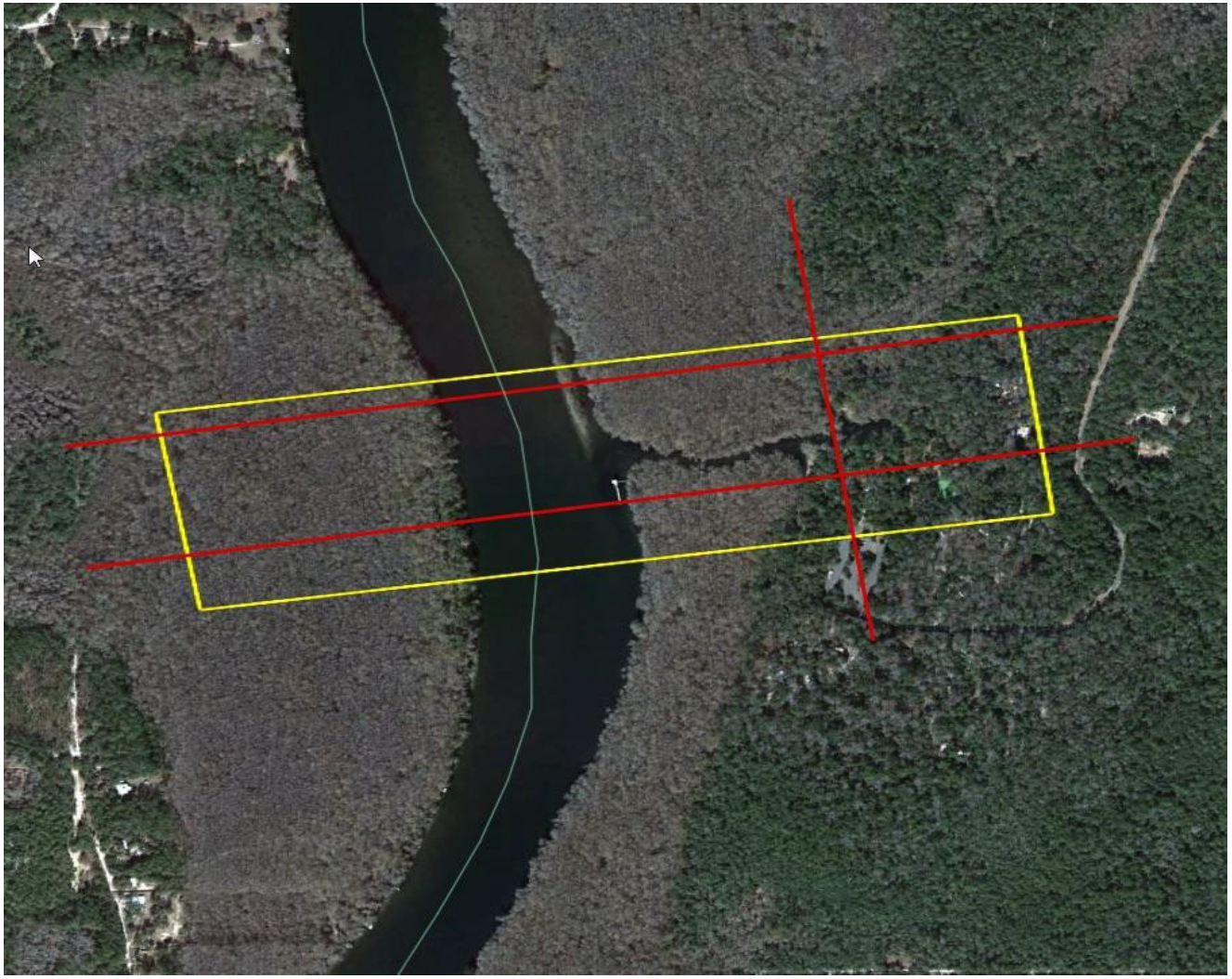
Manatee Springs Tree Canopy

Manatee Spring Run

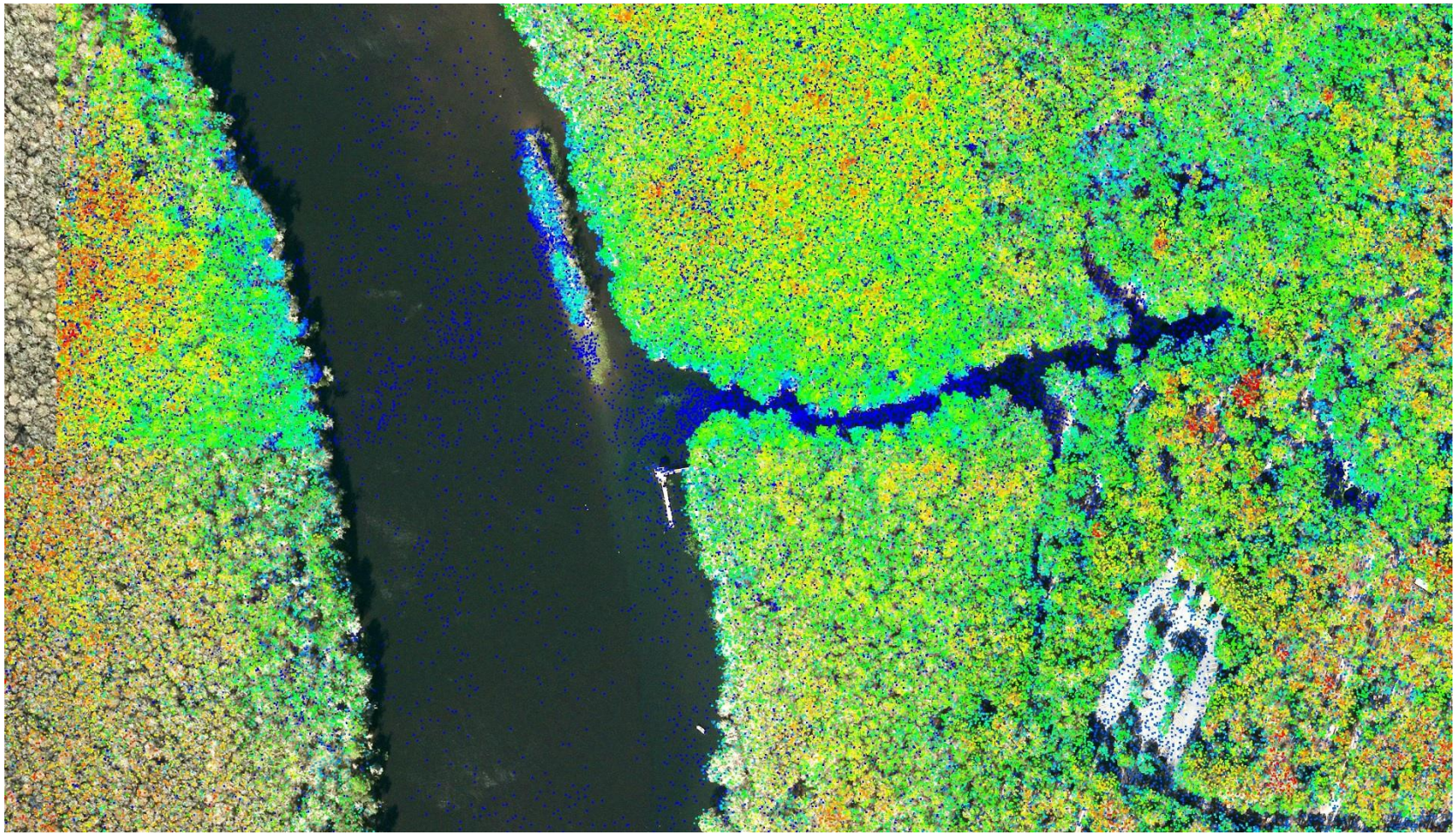
Manatee Springs – Suwannee River

Suwannee River

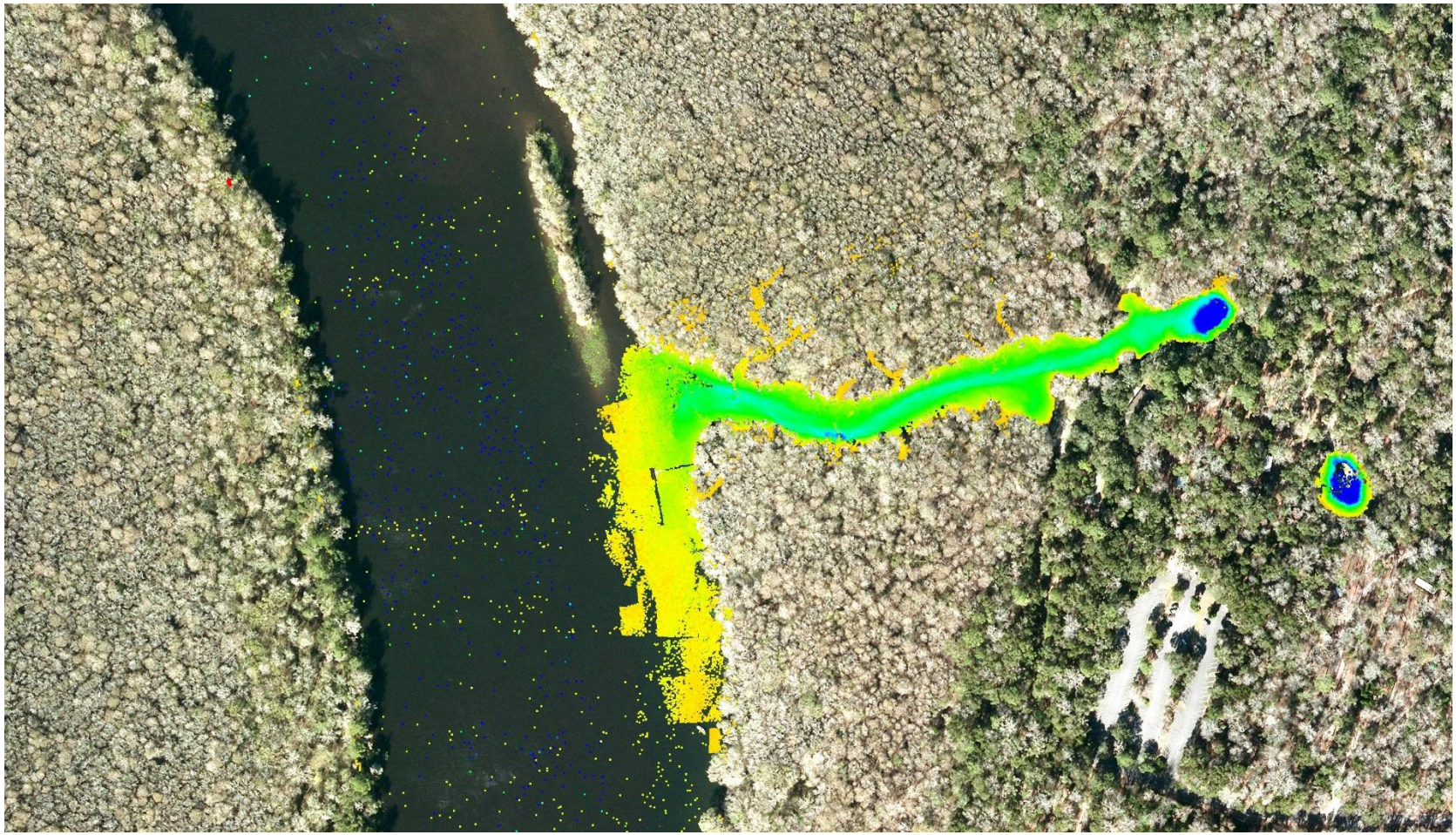
Flight Paths for LiDAR Flights



Sample of Point Cloud

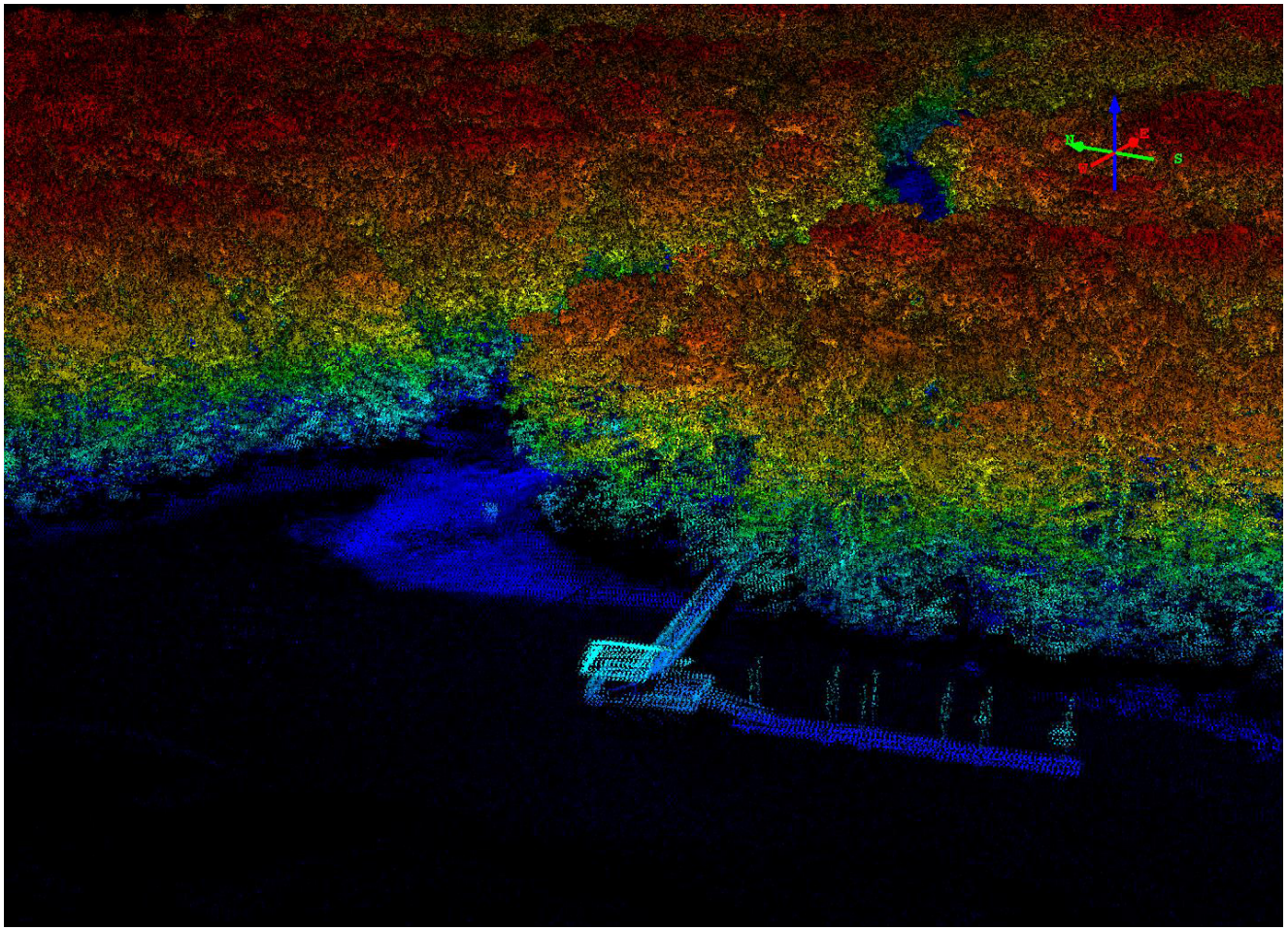


Classified Points
(not all of point cloud classified)

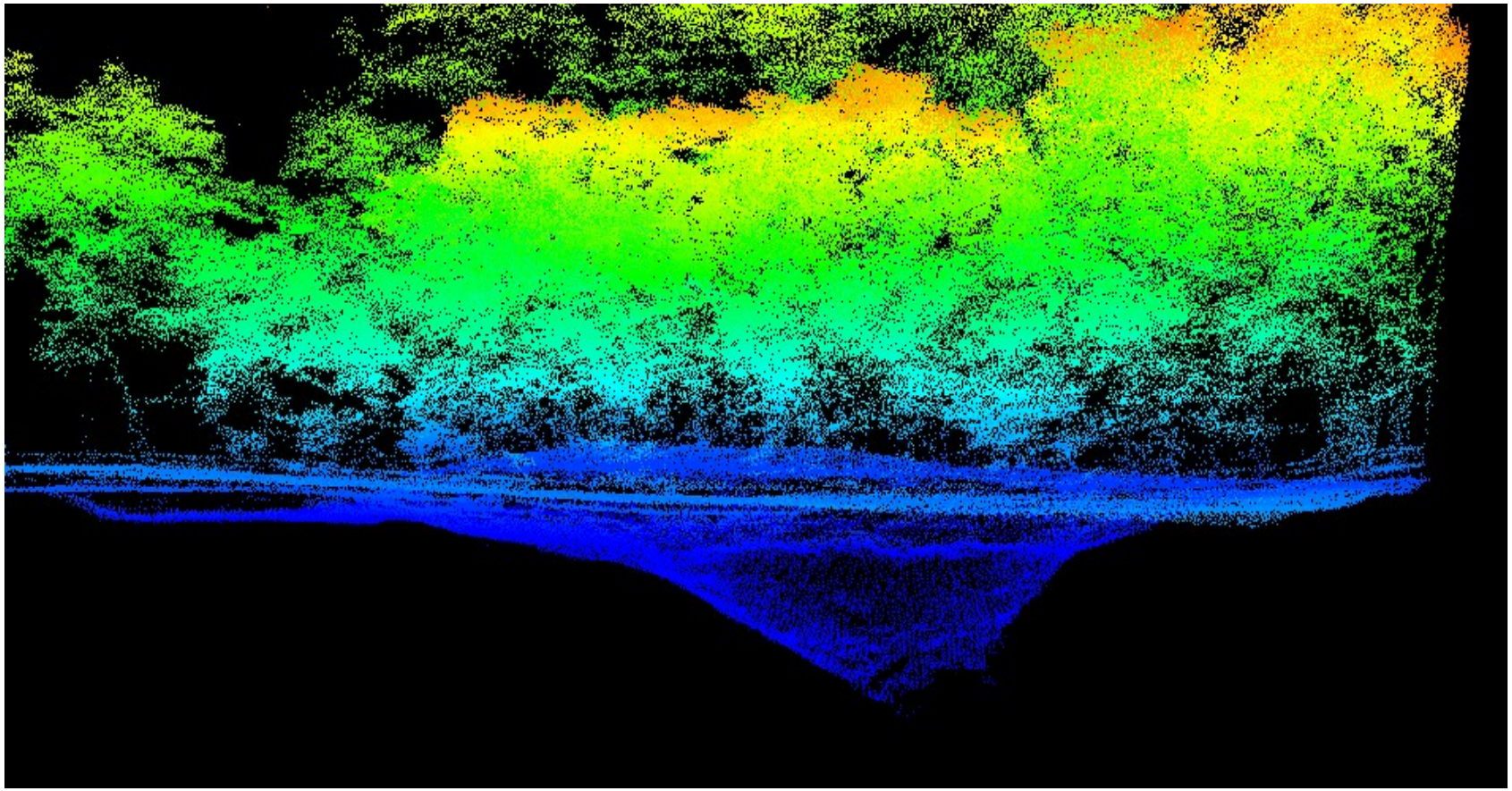


Typical Cross Section of Manatee Springs Parking Lot Using LiDAR Data

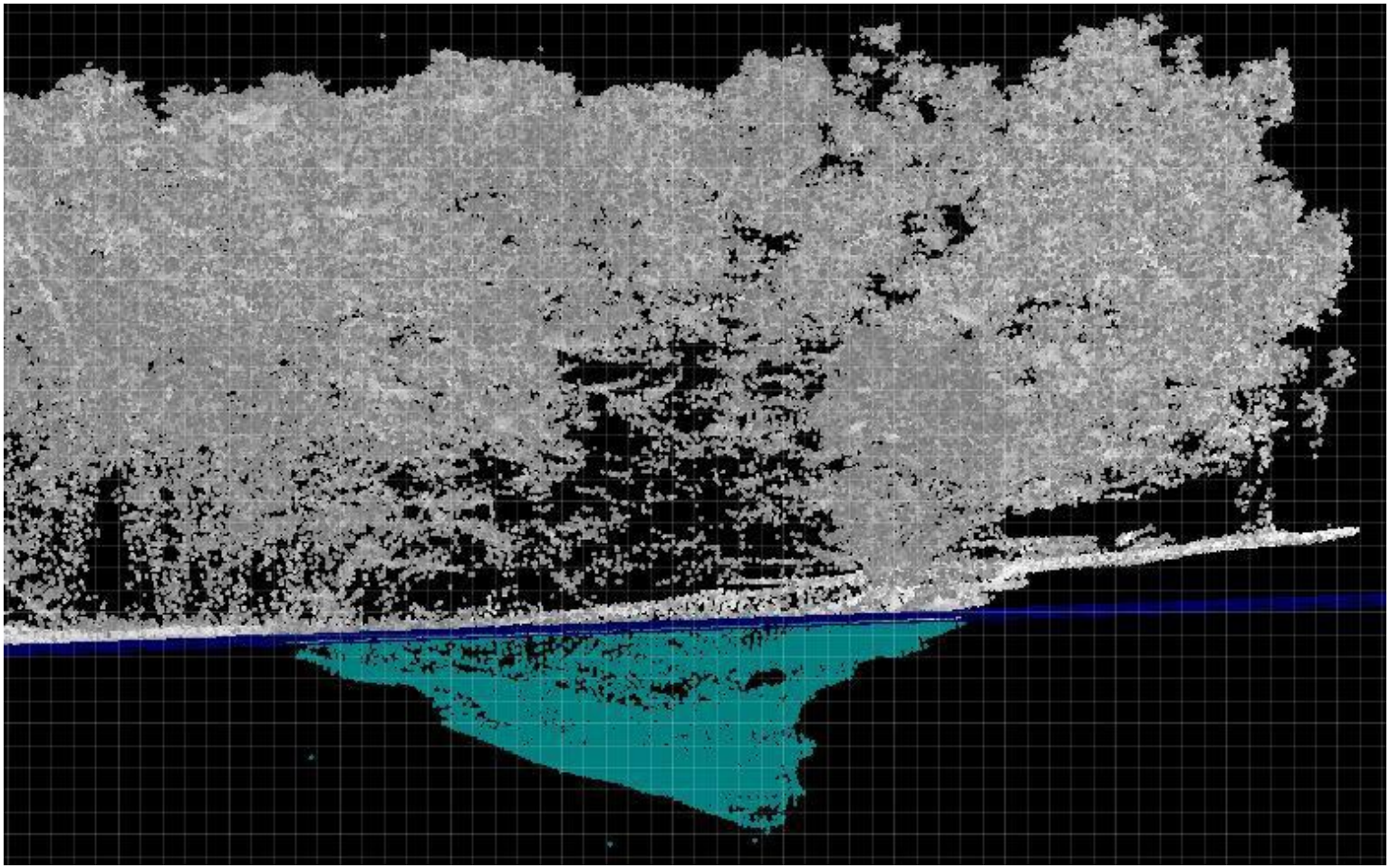
Manatee Springs Dock
Point Cloud (above water points)



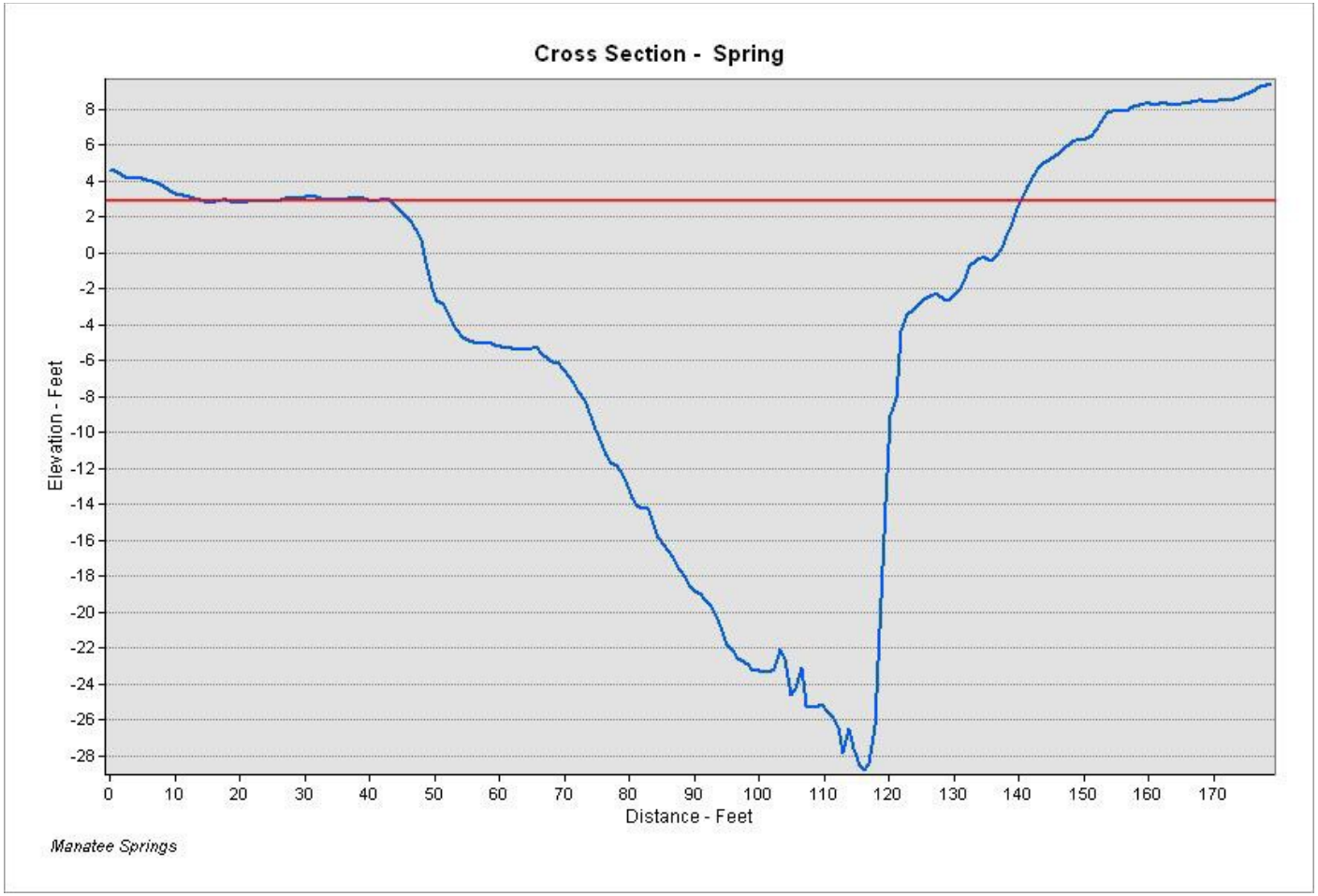
Typical Cross Section of Manatee Springs Using LiDAR Data



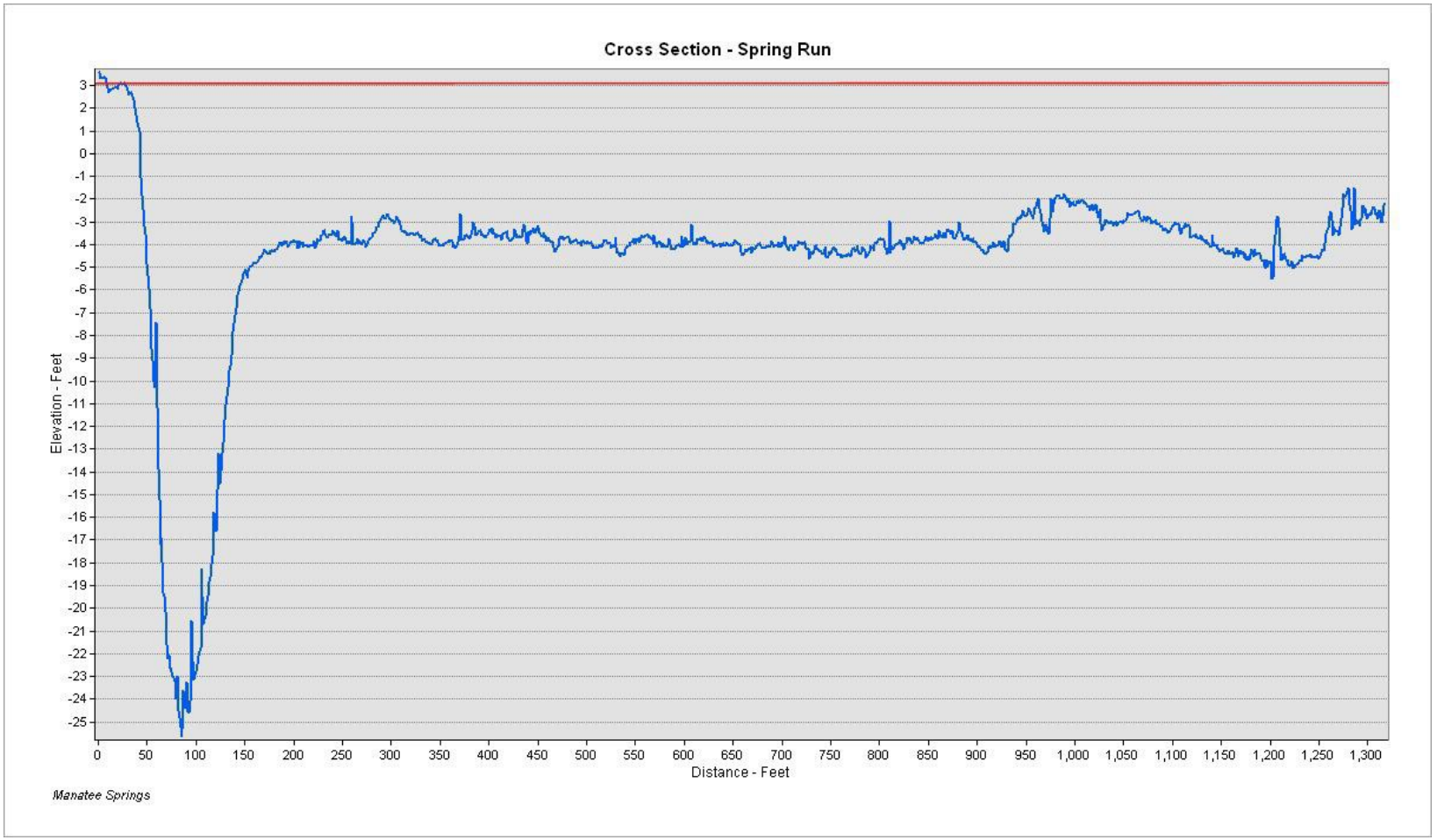
Typical Cross Section Across Spring



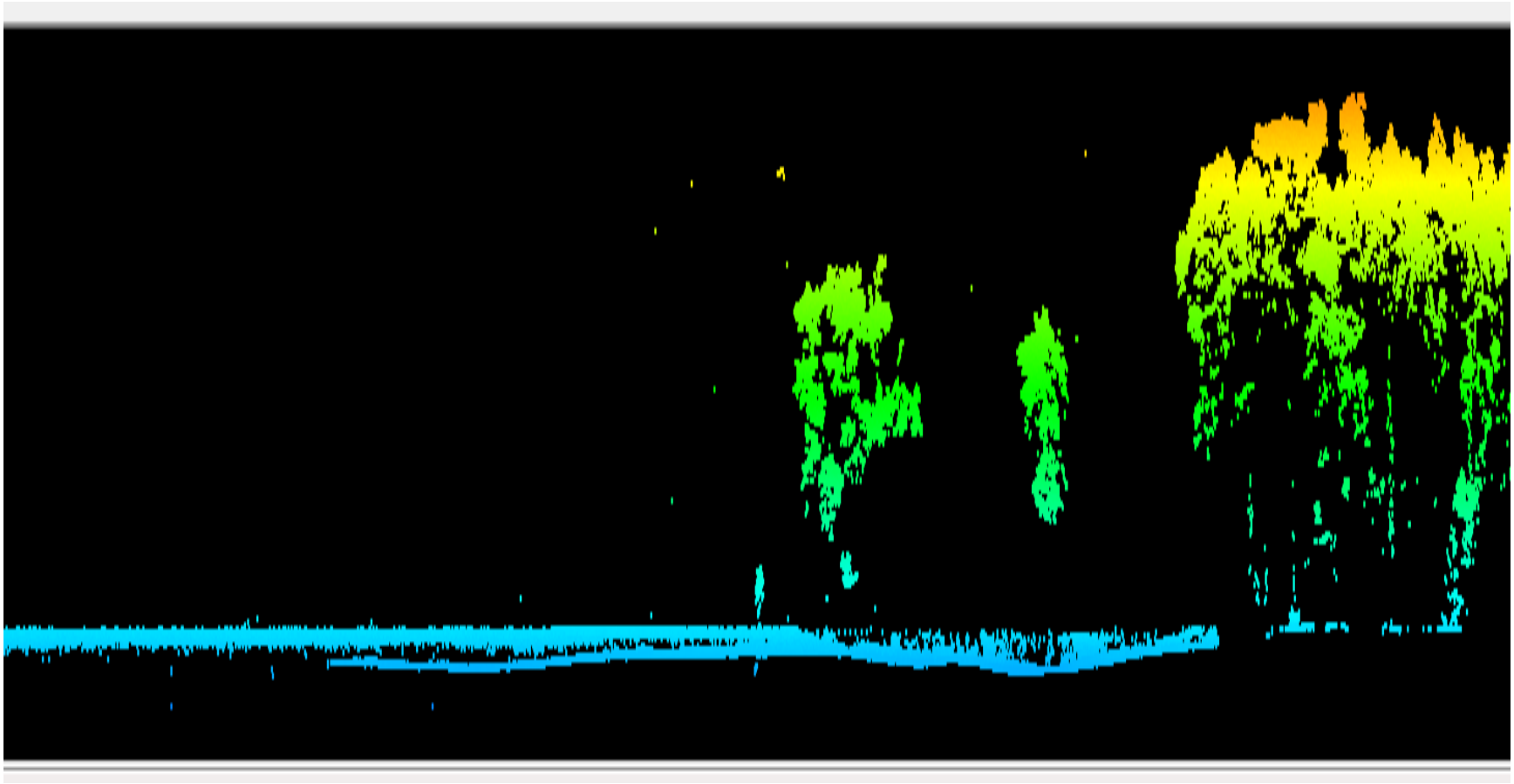
Typical Cross Section Across Spring



Cross Section Across Spring and Run



Cross Section into River



Analysis of Results

- Turbidity sampling In the river, Secchi disc readings down to 14.9 feet & unlimited in spring
- But depth penetration in river considerably less than Secchi depth
- Lack of valid returns in river apparently due to lack of reflectivity of bottom

Establishing Ground Control

Taking Test Soundings in Spring Run

Test Results

- Soundings made with a sounding rod at 31 locations in the spring basin and run
- Mean Error: 0.10 feet
- RM Error: 0.26 feet.

Safety Hazard (1)

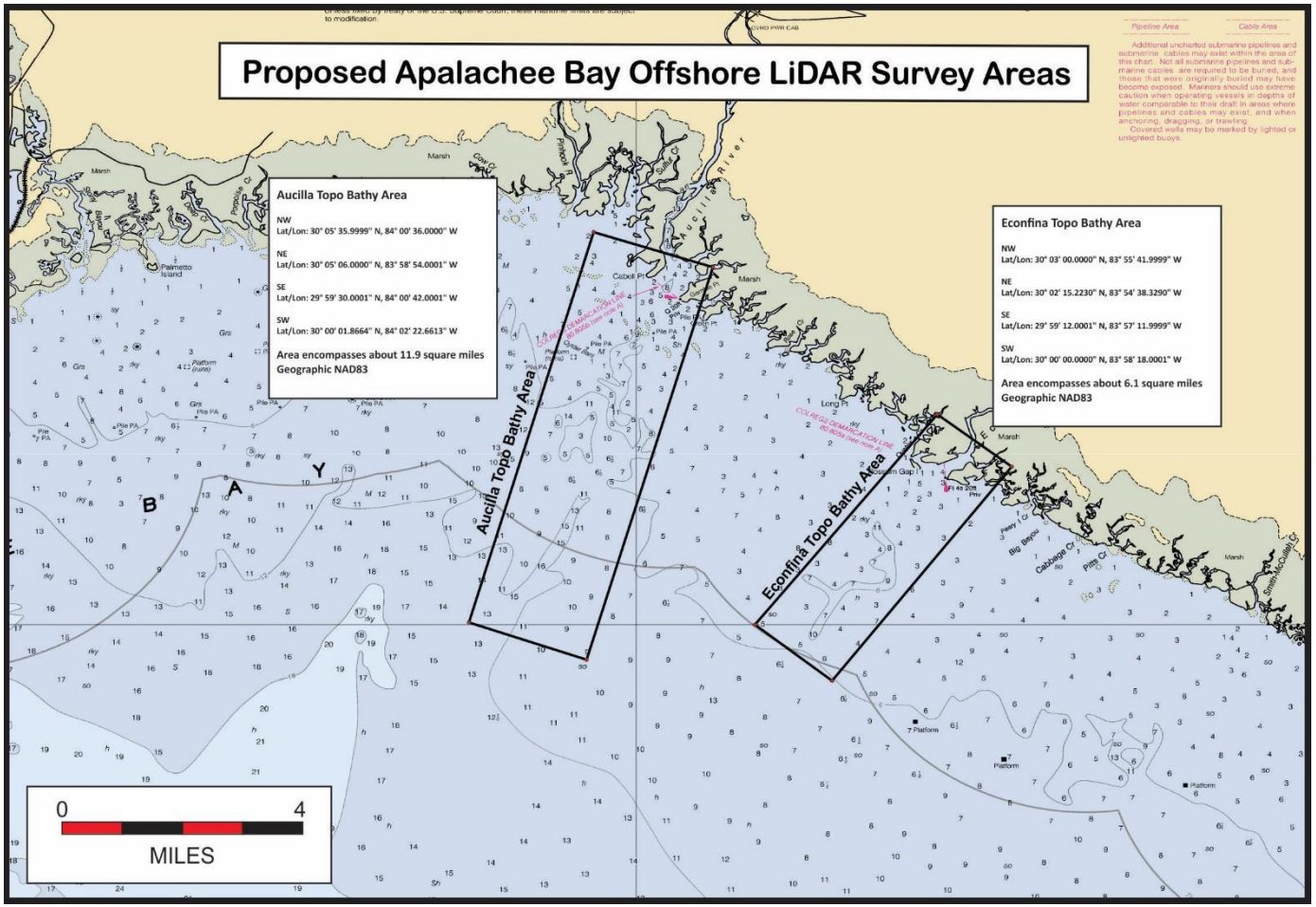
Safety Hazard (2)

Play Manatee Springs video

II. Aucilla & Econfina River Tests

- Conducted by Aucilla Research Institute
- Prehistoric river channels selected to map the many freshwater springs and Paleoindian sites now lying under the Gulf of mexico

Project Area



Project Area

Test Information

- Project flown by Dewberry Consultants, Quality Control & Data Processing assistance by Nobles Consulting Group
- Initial attempt used a Teledyne Optech Titan had lack of bathymetric ground reflectance
- Areas remapped using a Riegl VQ-880
- Rated penetration of about 1 Secchi depth up to 10 meters
- Area had Secchi disk readings down to bottom (>10 ft)

Typical Bottom Sample in Project Area

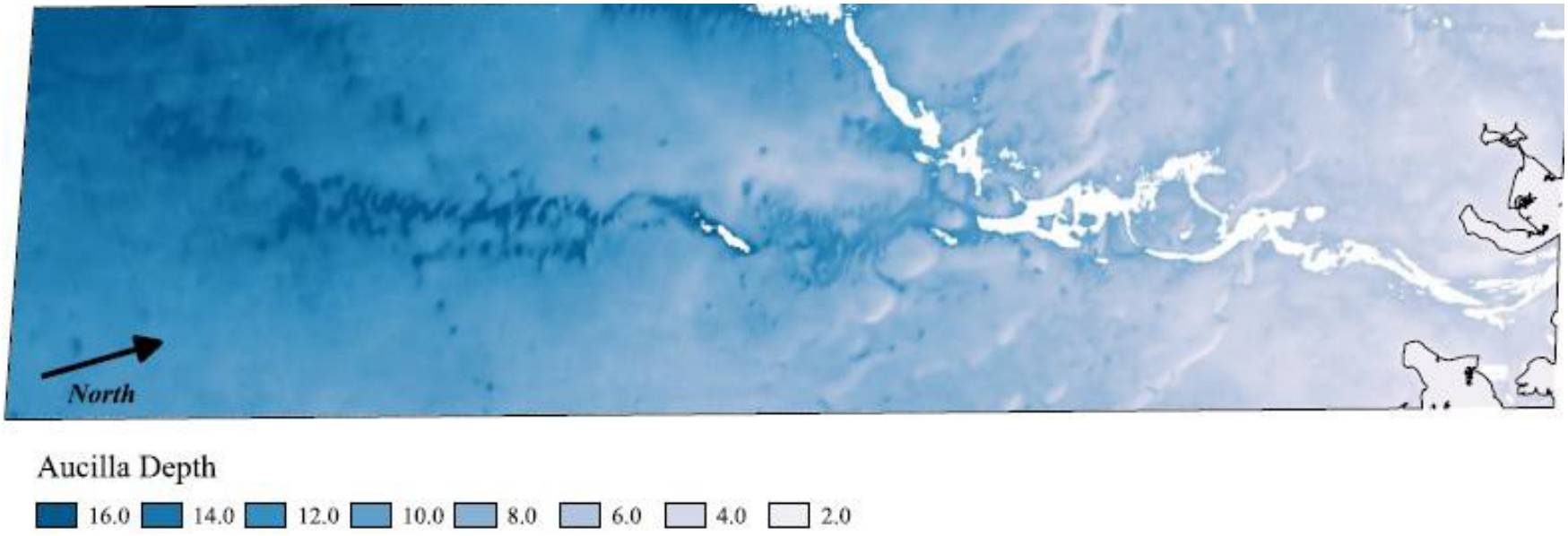
Flight Specs

- Riegl VQ-880 system uses a 532 nm (green spectrum) laser
- Data acquired from 400 meters AGL
- Swath width of 300 meters. A 30 percent side lap of flight strips was used to reduce laser shadowing. That flying height provided a measurement density of eight pulses per square meter.

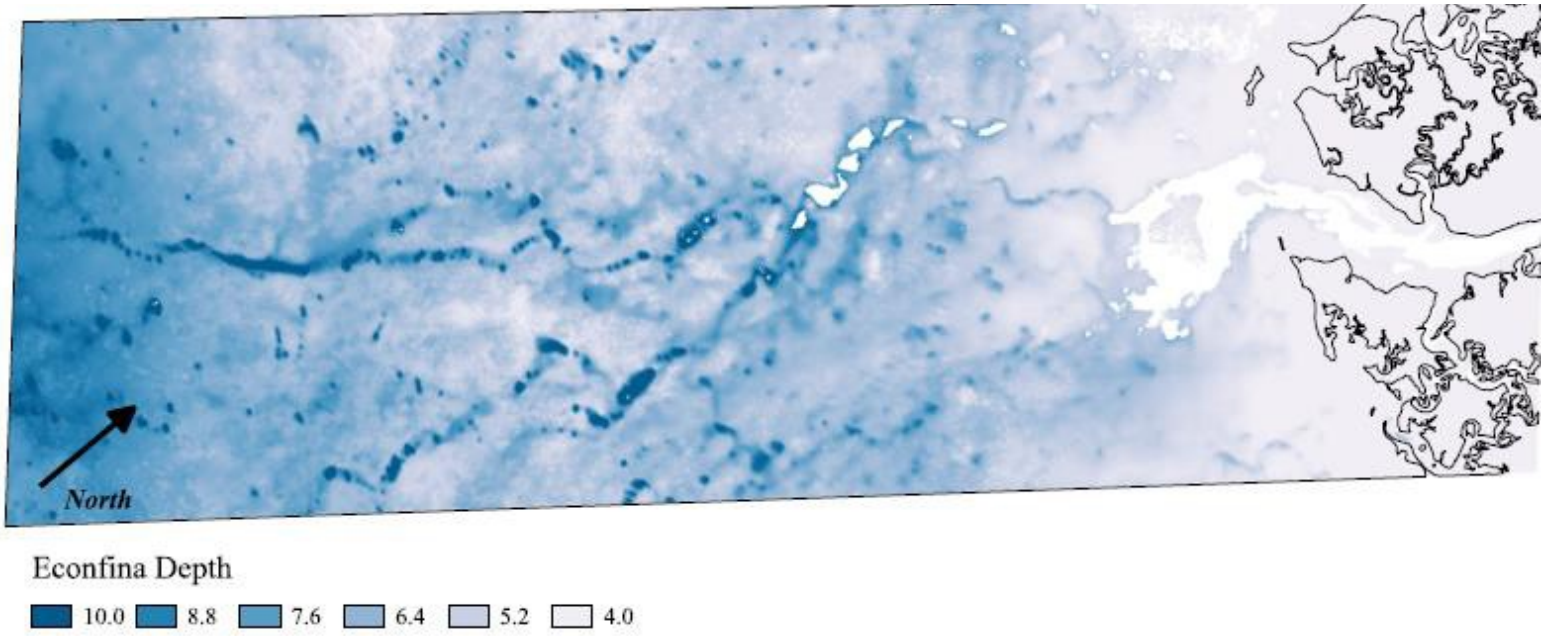
Results

- Fairly good LiDAR coverage for most of project
- Valid bathymetric ground returns except for portions of the channels near the current mouths of the rivers.
- Apparent cause -concentrations of turbidity in those deep areas associated with discharge of the rivers.

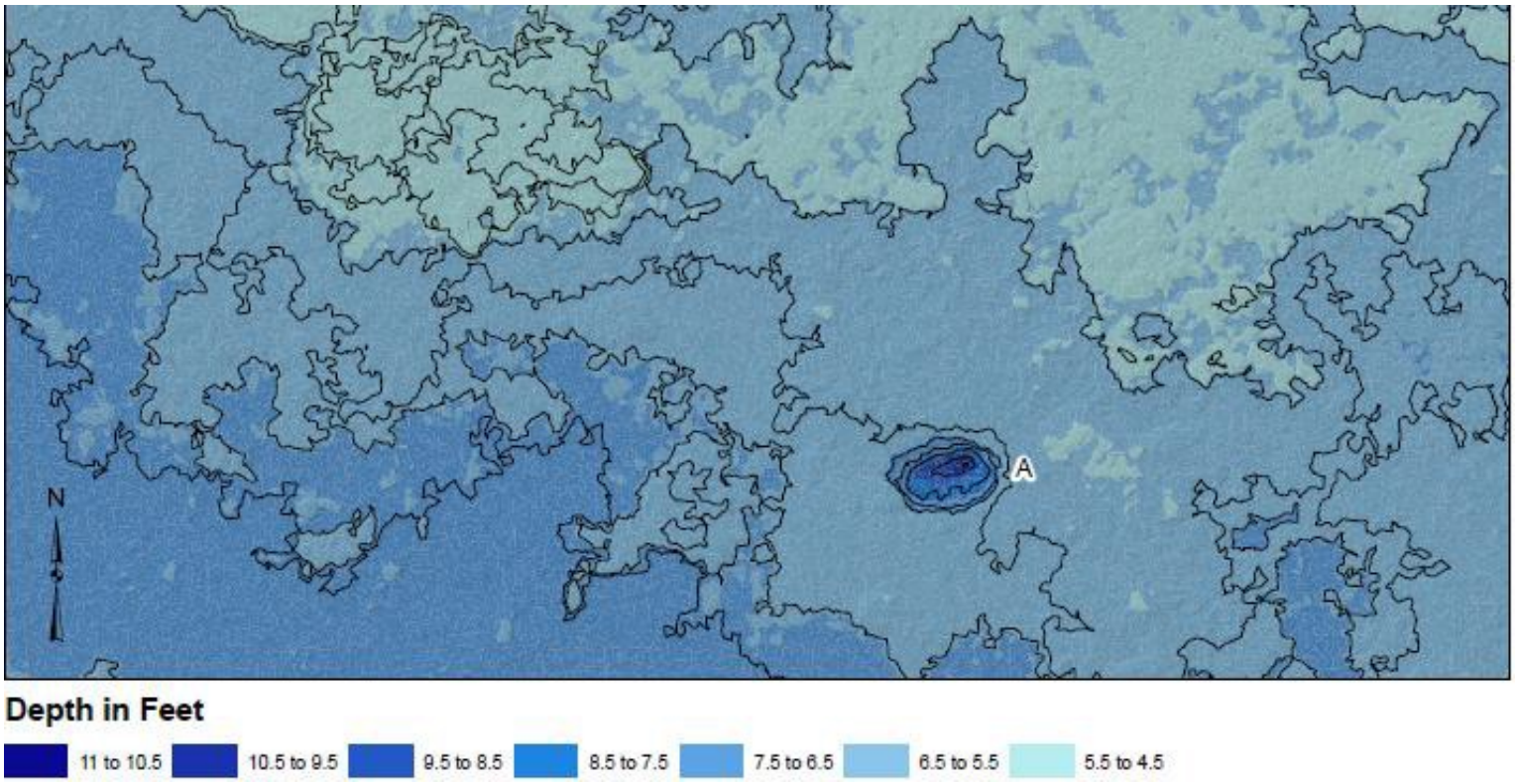
Coverage for Aucilla Channel (note blank areas)



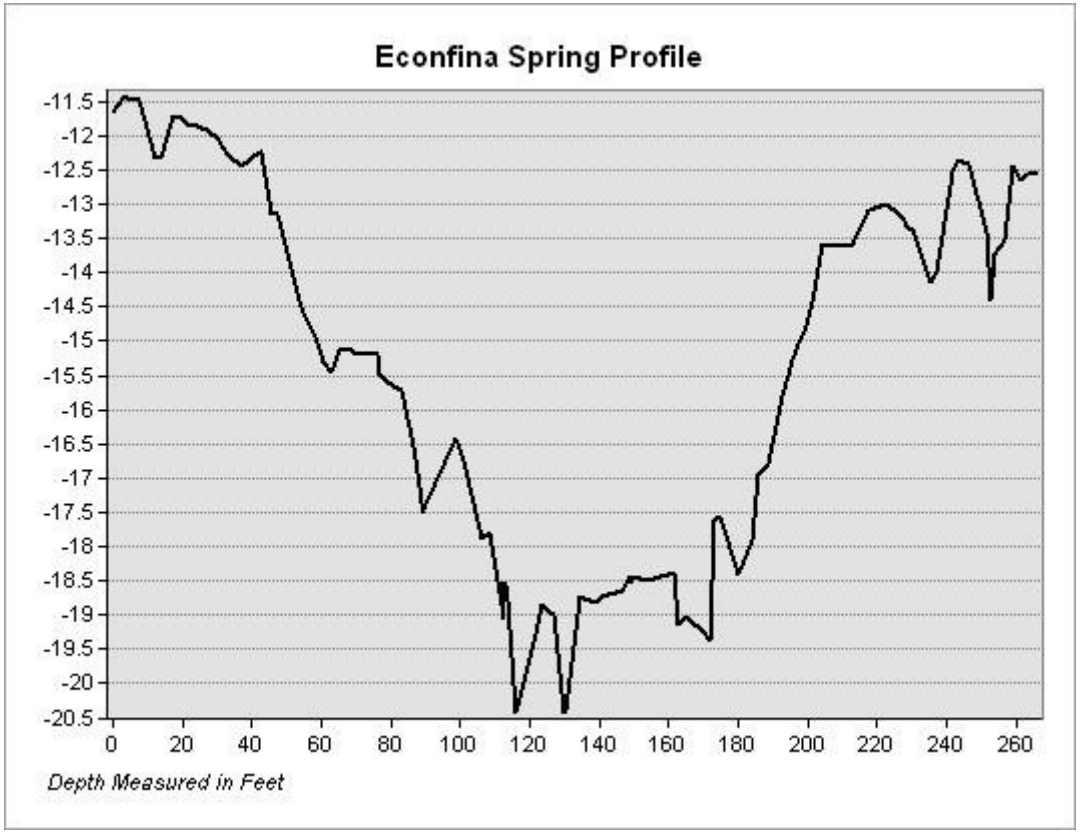
Coverage for Econfina Channel (note blank areas)



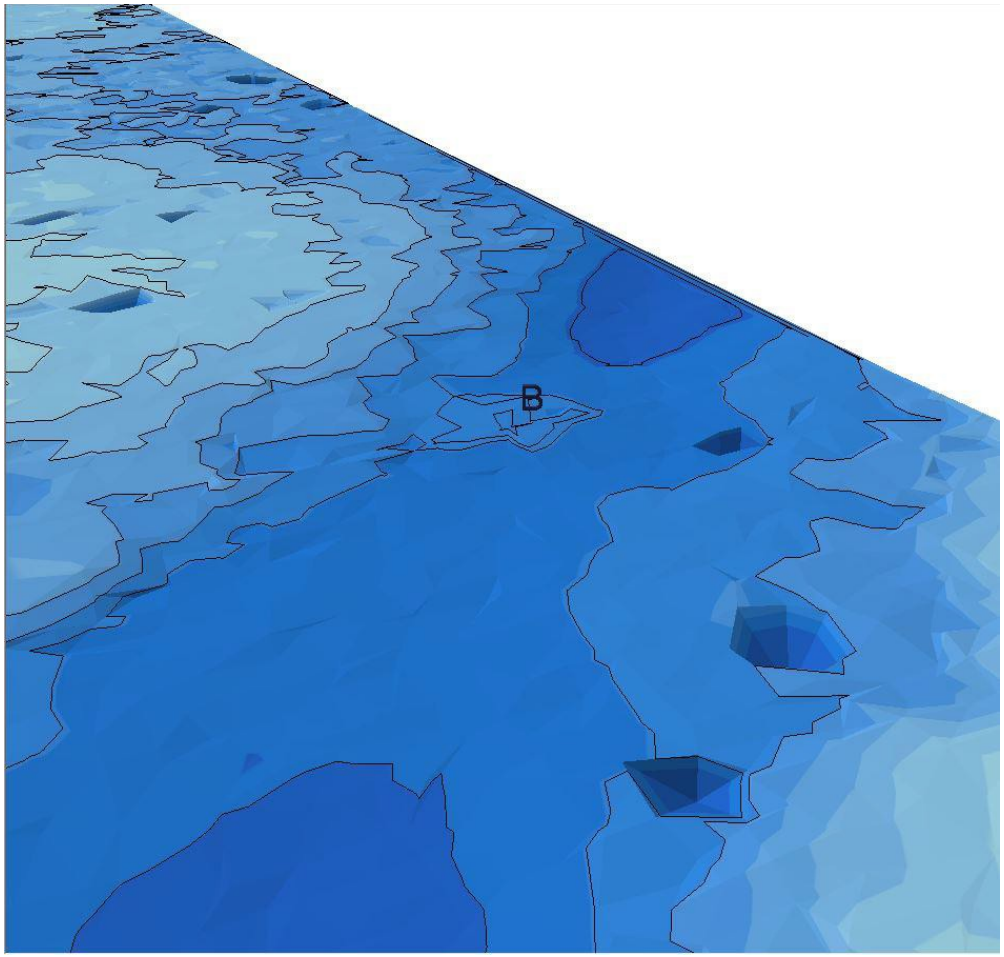
Typical Freshwater Spring (A)



Profile of Spring

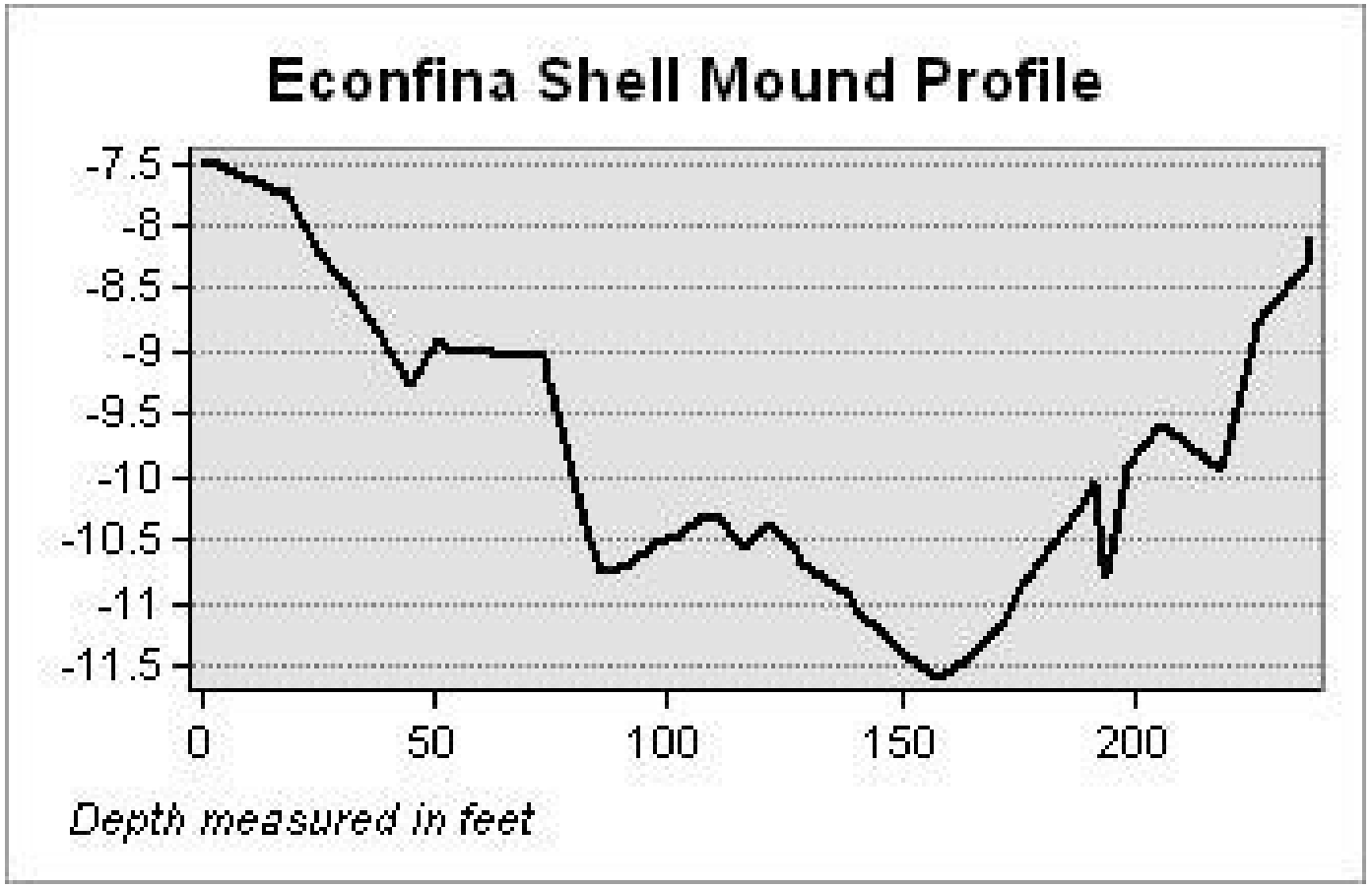


Typical Paleoindian Mound (B) on West side of Econfina Channel



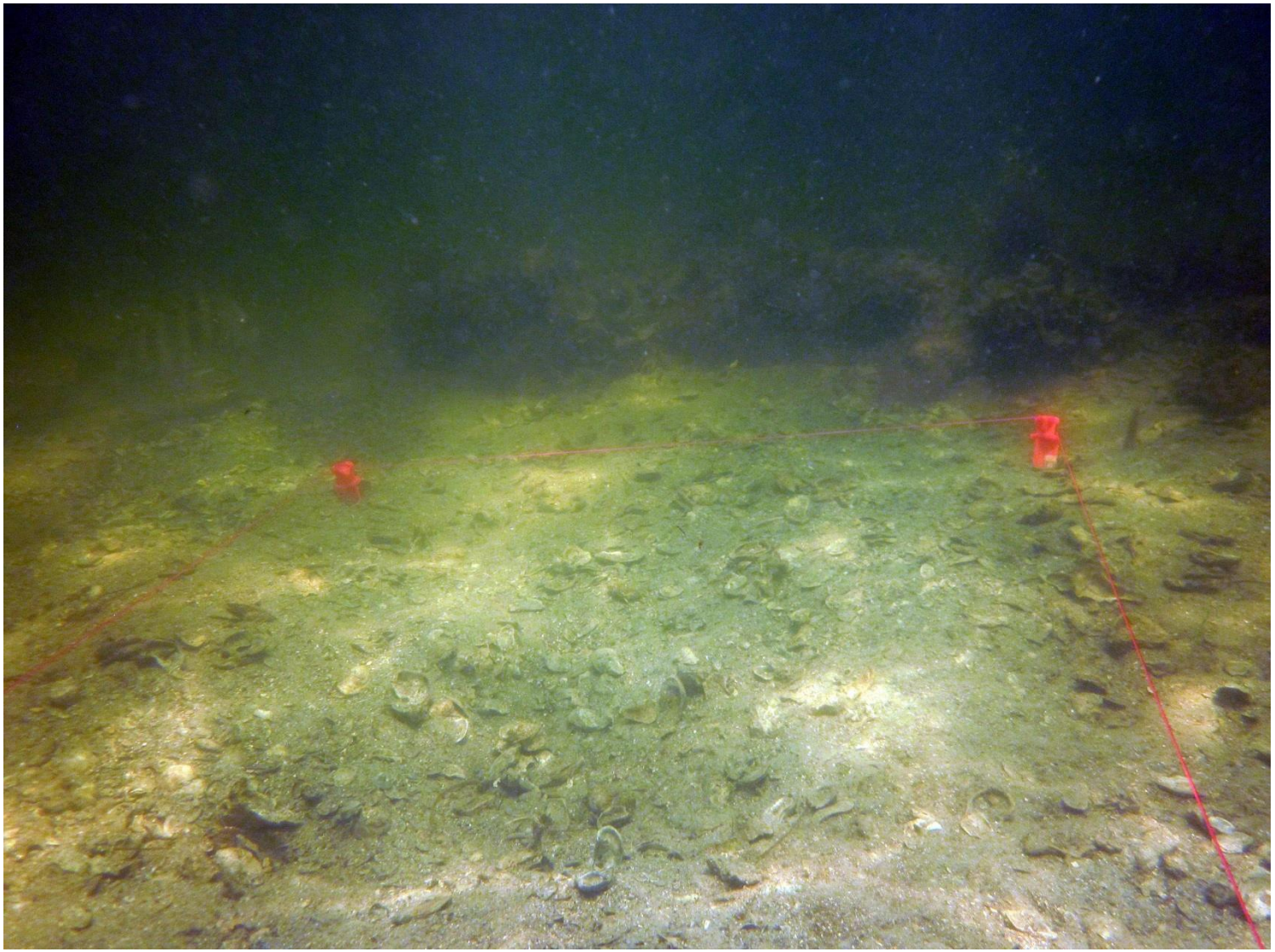
Profile of Mound

(plateau-like hump at left side of channel)



Underwater Photograph of Mound

(photograph courtesy of Jessica Cook Hale)



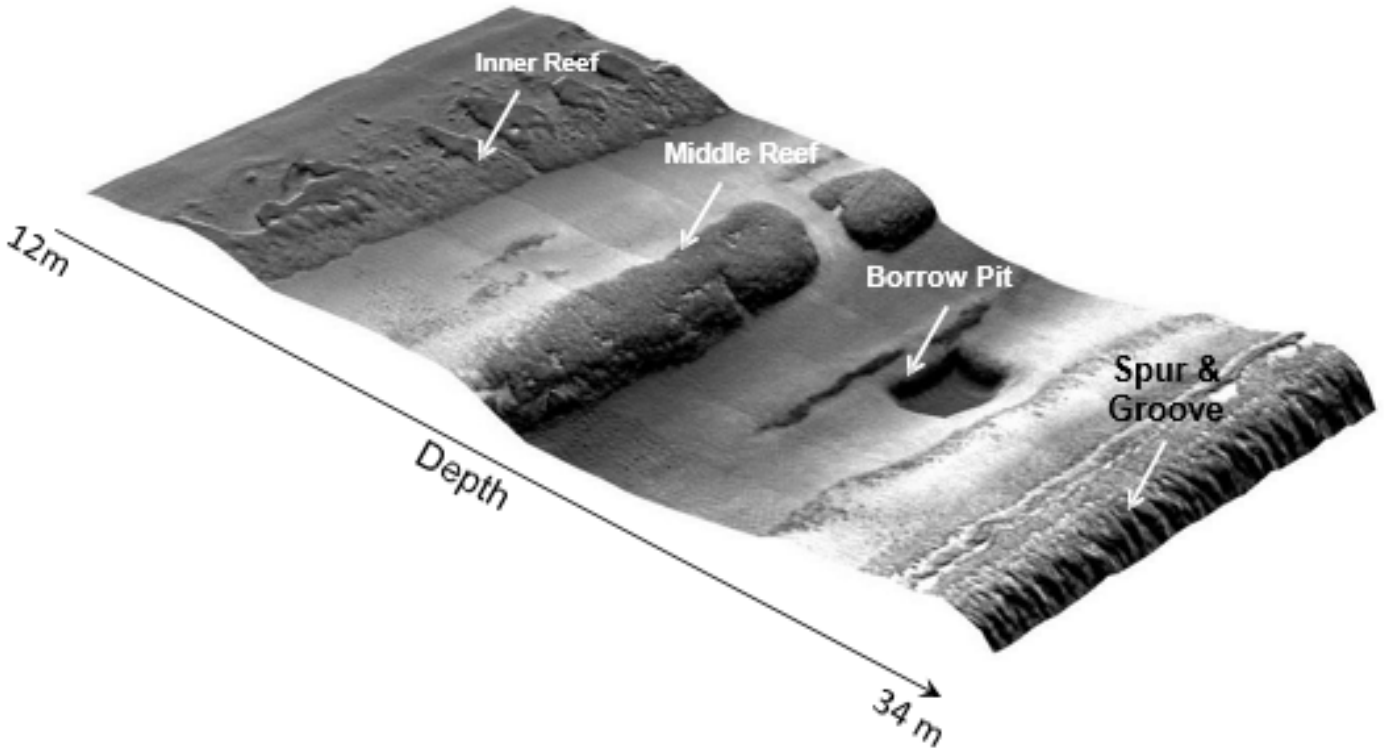
Underwater photograph of nearby limestone/chert outcrops littered with lithic debitage

(photograph courtesy of Jessica Cook Hale)

III. Example from SE Florida by Teledyne Optech

- Used Teledyne Optech CZMIL System

Tests off Ft. Lauderdale (note 34 m. (111 ft) depth)



Plan View of Same Area