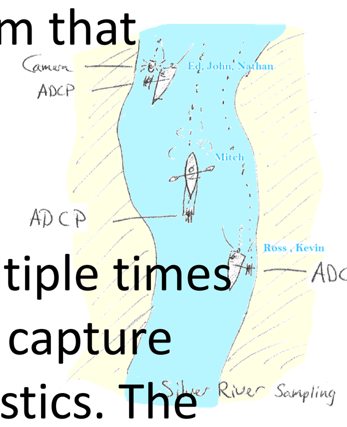
Silver River Sonar

Results of ADCP Sensor Data Collected in the Silver River, Florida 2014-2015

By Ed Carter and Amanda Tudor

Introduction:

As a part of the Springs Initiative, the hydrodynamics section of the Engineering Bureau at St. Johns River Water Management District is charged with modeling the flow along the Silver Springs and Silver River's 8.6 km run. To accomplish this, several Acoustic Doppler Current Profiler's (ADCP's) equipped with M9 sensors are employed seasonally to map velocities in the water column and collect bottom elevations. The Silver River provides some great opportunities and challenges to this task. These include: very dense and relatively tall Submersed Aquatic Vegetation (SAV) over most of the bottom, cypress tree roots and emergent plants in the shallows, turbulent and vertical flow especially in the springs area, turbid and rapid flow through the log strewn lower river, overarching and dense cypress trees that block GPS signal, reverse flow in back eddy areas, islands, both tributaries and a distributary, and an undulating bottom that changes elevation over short distances.

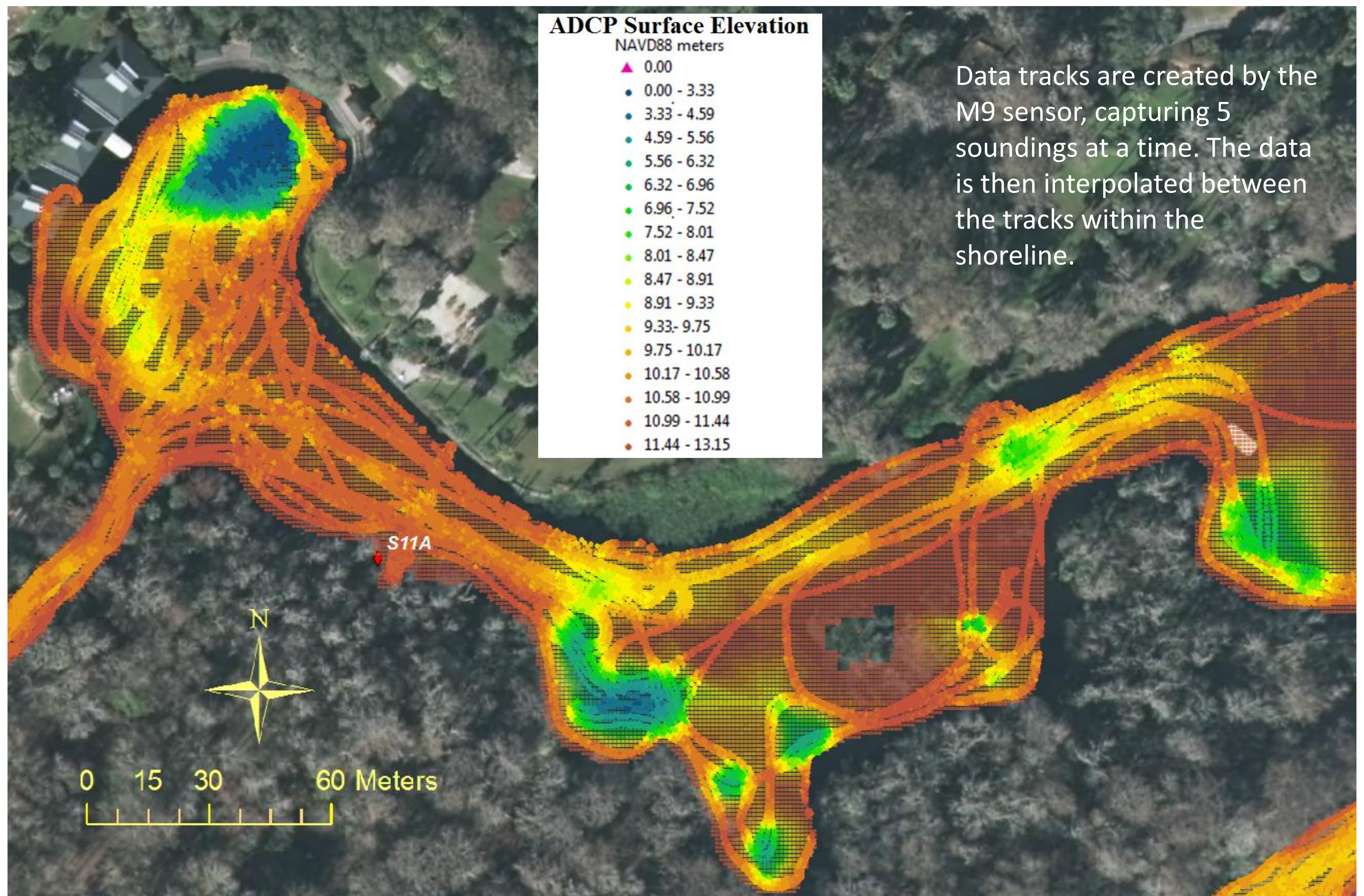


Method:

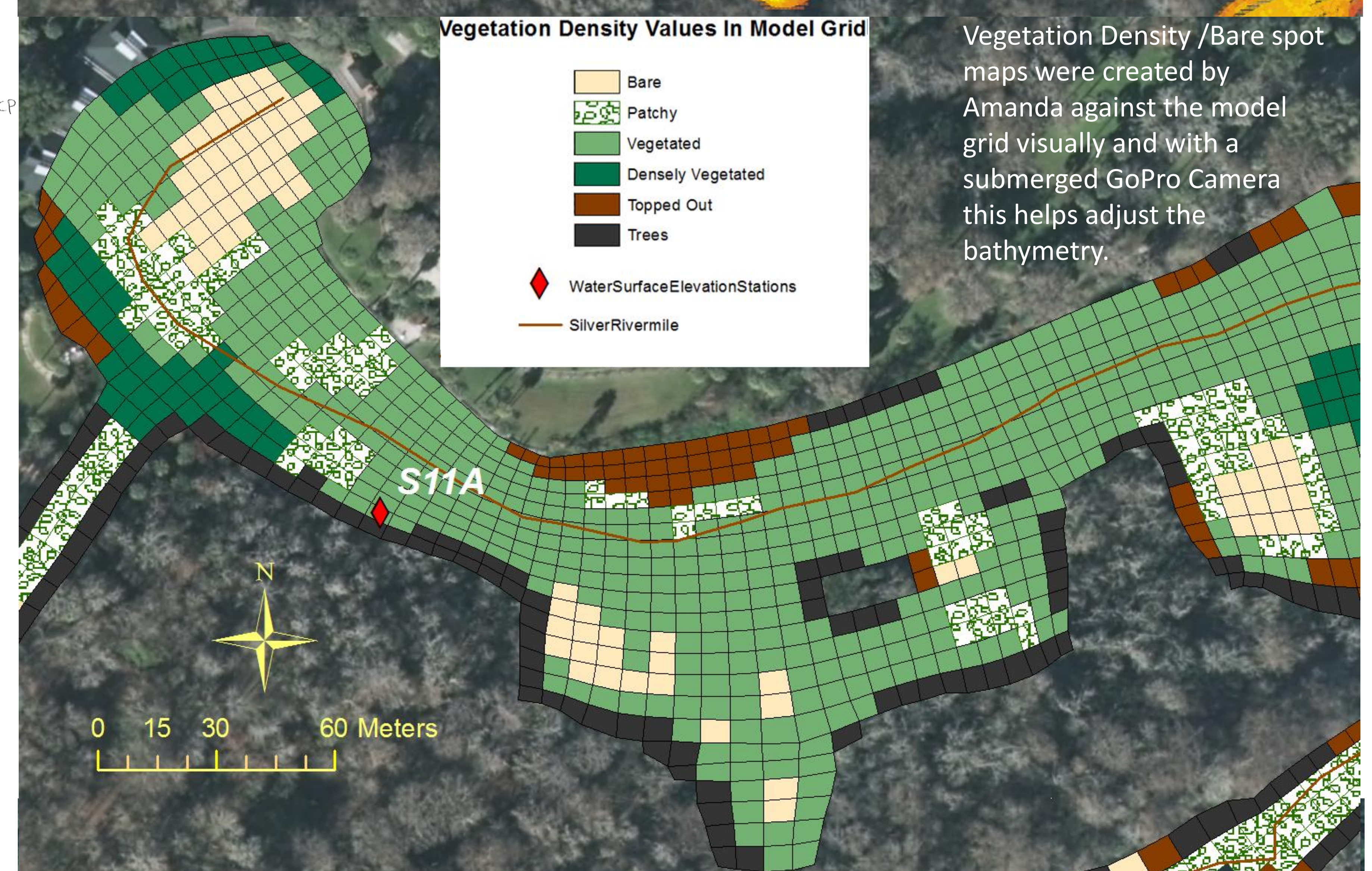
Up to 3 ADCP sensors are directed down the river multiple times over the course of a few days creating data tracks that capture the rivers current configuration and bottom characteristics. The sounding depths are converted to NAVD88 elevations using water surface elevation data from up to 13 stations along the Silver and Ocklawaha rivers. When analyzing the initial results, it is apparent that limited penetration of the vegetation canopy is all that is returned. This provides both a hindrance to bathymetric mapping and an opportunity to monitor SAV changes in different seasons and reconfiguration under alternate flow conditions.

Karst Environmental Services Inc. divers are collecting velocity measurements 20cm above the canopy and midlevel within the canopy, sediment surface elevations, canopy height, species, and blade length seasonally. This consistently shows that velocities drop an order of magnitude within the beds and proves the ADCP is capturing the majority of flow within the river system.

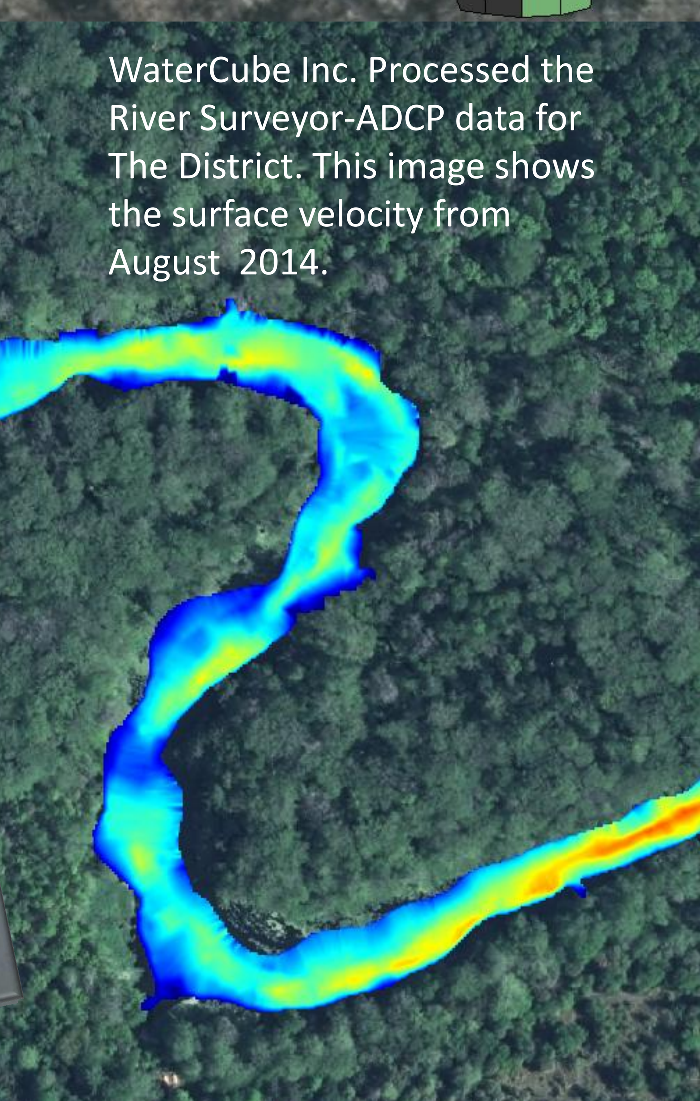
The ADCP soundings do a great job capturing the shape of the river but not the bathymetry below the vegetation. Numerous transects are surveyed to quantify the error and adjust the ADCP data surface to more accurately estimate the bottom elevation. Bare spots requiring no adjustment were mapped visually and with a submerged gopro camera against the velocity grid.



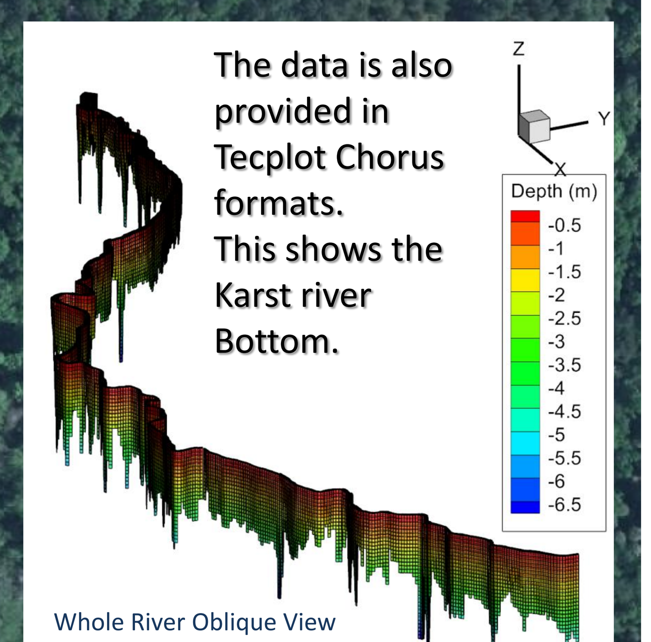
Data tracks are created by the M9 sensor, capturing 5 soundings at a time. The data is then interpolated between the tracks within the shoreline.



Vegetation Density /Bare spot maps were created by Amanda against the model grid visually and with a submerged GoPro Camera this helps adjust the bathymetry.

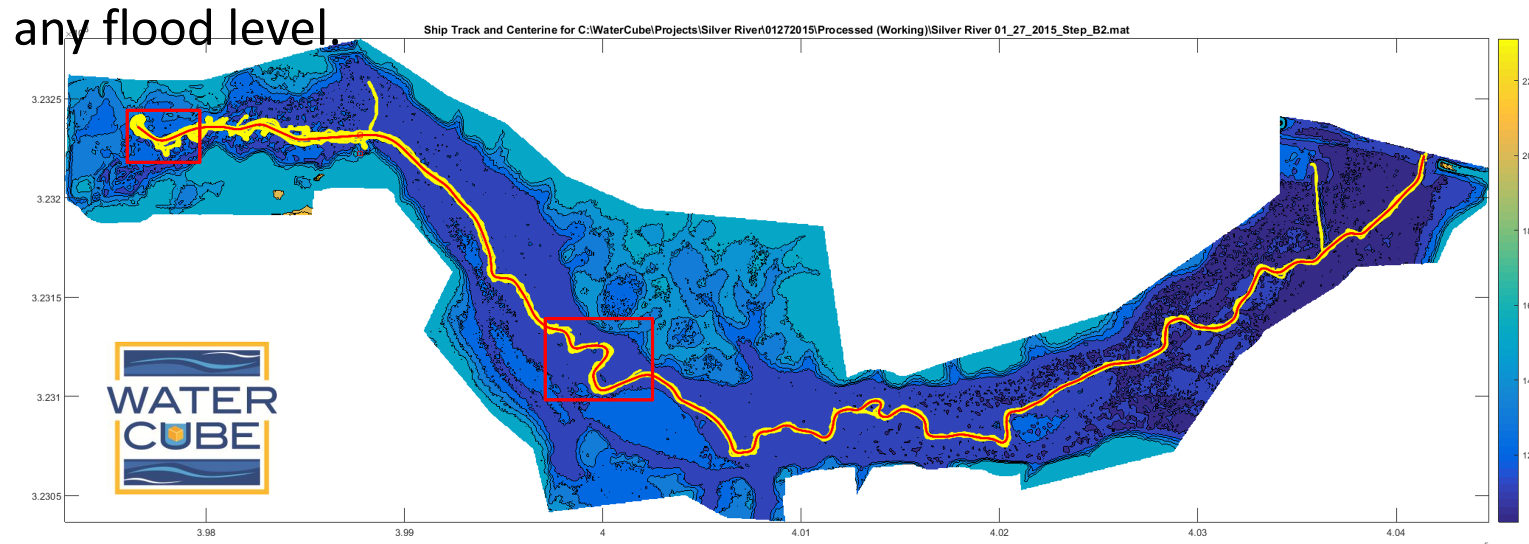


WaterCube Inc. Processed the River Surveyor-ADCP data for The District. This image shows the surface velocity from August 2014.

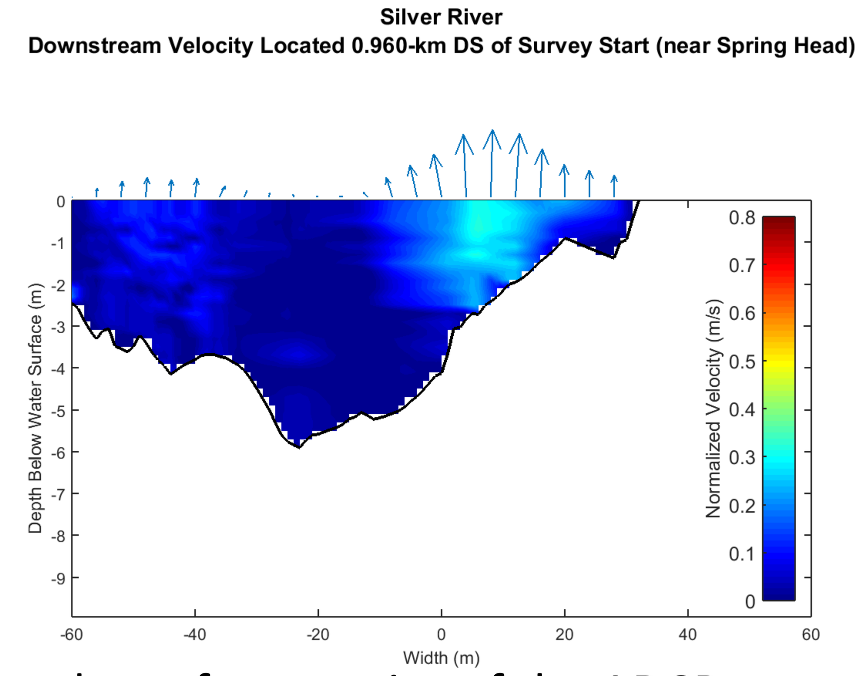


Products:

To Date 4 datasets have been collected with River Surveyor Software and 3 have been processed by WaterCube Inc. including August 2014, January 2015, and April 2015.
August 2015 is being processed now.
These data can be integrated with the floodplain to produce a Digital Elevation Model (DEM) that represents any flood level.



Full River 3D Velocities allow creation of virtual cross sections at any point in the river.
WaterCube also provides velocity slices at defined depth intervals.



Challenges:

Although the software and transducer frequencies of the ADCP do not accurately define the vegetated bathymetry, they do define the vegetation canopy. This has allowed for seasonal and velocity reconfiguration change analysis. GPS antennae have improved to assist in position acquisition under dense cypress. "Topped out" plants, floating vegetation, and very shallow water with solid objects too near the sensor, still prevent good data capture. True dual frequency sensors could provide confirmation.

Strengths:

This developing technology allows us to capture whole river snapshots of 3D flow conditions in a very time efficient manner. It captures general bottom morphology, and top of canopy of macrophytes and logs. ADCP surface data
Provides excellent support for hydrodynamic modeling efforts.

Acknowledgements:

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www.watercubedata.com www.karstenvironmental.com and www.floridaswater.com