Application Note

Bathymetric Survey of Remote Lakes Collects High-Resolution Data for Impact Model of Hydroelectric Plant

As soon as the thick fog thinned to pale wisps, the pilot steered the helicopter through bands of low clouds, between two mountain peaks, zipped past a waterfall, and followed a creek to an elevated valley where, 20 minutes later, he dropped Adam McCullough, Matt Previte and their equipment on a narrow patch of green. Nestled between the pristine peaks, the men set out to survey the bathymetry of two remote lakes for a proposed hydroelectric project in southeast Alaska.

"There's just not that much data out here. The lakes are remote and off the road system, so they're not extensively studied," said McCullough, GIS Manager for OASIS Environmental.

Local residents use the lakes for fishing and recreation, but the Alaska Department of Fish and Game (AK DFG) required volumetric mapping of the lakes to assess the potential impact of a planned hydroelectric power plant.

The Department was interested in baseline data: Would the proposed hydroelectric operations alter habitat at the inlet delta and connectivity to fish spawning areas in the headwater stream? Would proposed hydroelectric operations at the headwater lake alter the littoral zone habitat in the lake downstream?

To facilitate the data collection, McCullough's employer, OASIS Environmental, was hired by the development partners of the hydroelectric plant to conduct wildlife, fisheries and vegetation studies. OASIS, in turn, partnered with YSI Incorporated to conduct the bathymetry studies of the two lakes plus a tidal study near the powerhouse construction site to gather baseline data to assess potential dredging requirements.

YSI EcoMapper AUV collected bathymetric data across two lakes in a remote Alaskan mountain region

After downloading geo-referenced maps, YSI's Matt Previte quickly programs a route in the headwater lake for the EcoMapper AUV

Underwater Vehicle Captures High-Res Data of Lake Bottom

The bathymetry model required high-resolution data, down to one-foot contours, to accurately assess the lake features down to forty feet. A previous model of the headwater lake, which used a sonar instrument on a boat, yielded five-foot elevation contours of the lake bed and banks.

However, for this project, "we needed to see the details, the tight little undulations, such as a small shelf at two feet above the main channel for fish spawning," said McCullough.

YSI's EcoMapper AUV, which uses side-scan sonar and a SonTek Doppler velocity log, provided the detailed data that McCullough was looking for. The four-foot, self-propelled vehicle does not require a boat; its operator can stay mostly dry and safely on shore to conduct a mission.

YSI's Technical Specialist Previte observed, "One of the lakes had a particularly steep and rocky terrain, so we did use a human-powered jon boat when we had no habitable shoreline to work from."

Out on the rugged shoreline of the lake, McCullough dealt with acquiring terrestrial GPS positions while Previte entered coordinates and routes into a laptop to program the EcoMapper's mission. Once ready, he launched the EcoMapper into the water and the vehicle began to dive and swim, collecting bathymetric data. (Although not a primary objective for this project, the vehicle also continuously collected water quality parameters including optical Dissolved Oxygen, pH, Turbidity, Chlorophyll, Temperature, and Specific Conductance. Additionally, water column profiling was conducted in deeper waters to assess salinity and temperature gradients, which impact

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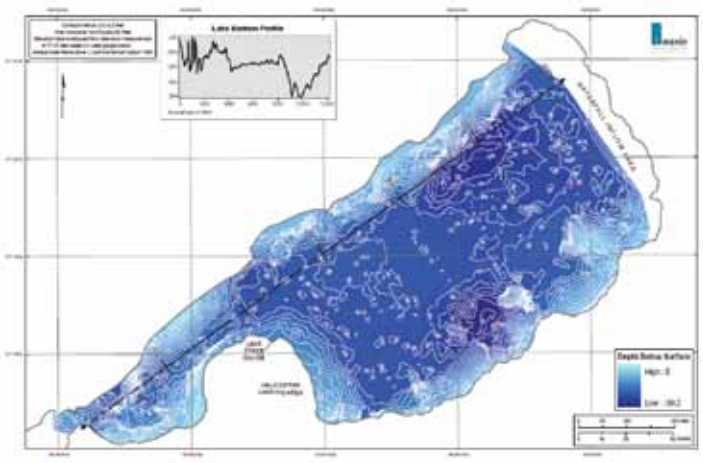
the speed of sound and thus the accuracy of the bathymetry measurements.)

"The EcoMapper is pretty cool. It went into the shallower ends of the lakes, in waters two or three feet deep, and it even navigated up the river delta. We got an accurate one-foot vertical bathymetric elevation model from the data it collected," McCullough reported.

"What really convinced me to use the EcoMapper was when I learned that OASIS could rent the vehicle and that YSI would send a trained employee to operate it for me. That made it a whole lot easier," continued McCullough.

While OASIS provides a variety of ecological, hydrological, environmental compliance, and associated mapping services, the company's staff did not have the equipment or experience working on bathymetry projects. So, they knew they needed a partner to complete that portion of the survey project.



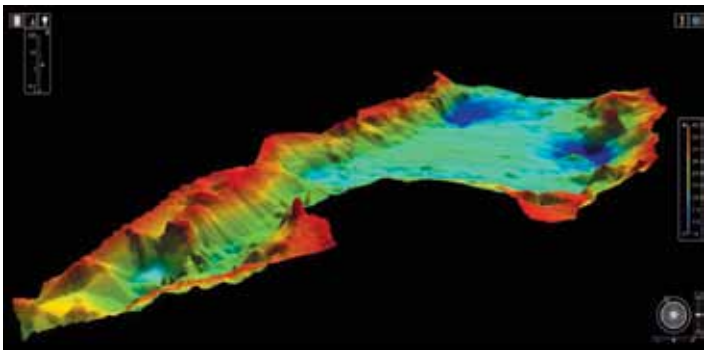
Lake-bottom profile of headwater lake

Modeling Lake Contours for Environmental Assessment

After five days of rainy weather and data collection—three days mapping the bathymetry of the intermediate lake, one day at the delta of the headwater lake, and one day in the tidal area—Previte downloaded the data, compiled field notes, and provided QA/QC on the raw data before sending the datasets to OASIS.

Back at his office, McCullough tackled further analysis and data visualization, using software to create 3-D subaquatic elevation models. Data collection, processing, and models were quality checked by a licensed surveyor throughout the project.

The hydroelectric developers and agencies now have an accurate and comprehensive view of the remote lakes for environmental impact assessments. Together they can make informed choices about changes to the natural resource as the hydroelectric project moves forward.



3-D elevation model of headwater lake

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