

CEESCOPE™ RTK Used for Bhutan E-Flow Project Surveys

Bhutanese surveyors conducted river bathymetry measurements for hydro power impact evaluations, assisted and guided by expert hydrographic consultant Christian Haas of IAMHYDRO GmbH, Germany. The extreme conditions meant that the CEESCOPE's exceptional shallow water bottom tracking was tested to the limit with water column aeration a constant challenge.

The E-Flow Bhutan project is a development aid project that aims to study various rivers with existing and future hydropower plants. Operated by the National Environmental Commission, Bhutan the project focuses on the "Environmental-Flow" or "E-Flow" which is the amount of water necessary to ensure a sustainable river ecosystem in the dewatered stretches of the rivers.



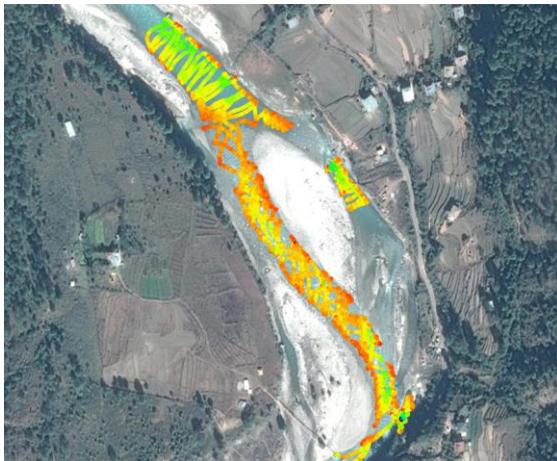
Understanding the topography around the river and also the bathymetry is required to generate a digital terrain model for computer modeling as part of the overall hydrological assesement.



Upon reviewing available technology, IAMHYDRO recommended CEE HydroSystems "all in one" CEESCOPE echo sounder system for the Bhutan surveys owing to its autonomous logging capability – required for kayak deployment – and shallow water performance. The RTK variant was selected to minimize vulnerable cables and components and allow direct connection to the Trimble R10 local base station for site control.

River cross sections were conducted from kayaks with a 200 kHz transducer at the rear of the boat. The CEESCOPE control unit was strapped to the kayak and all data were recorded on the internal memory for subsequent upload into HYPACK and Hydromagic software. The CEESCOPE automatically records optimized data files containing

all position, sounding, and water column information, providing a dataset identical to real time acquisition. Aeration and blinding of the sonar was unavoidable, however the surveyors ensured coverage was maximized with the expectation that much of the data would be thinned out to remove artifacts from the extreme environment. First, HYPACK® software was used by CEE HydroSystems to post process the bathymetry portion of the collected data. HYPACK and Hydromagic were used to provide visualization.



Topography of the survey area was gathered using traditional land survey measurements and aerial drone photogrammetry surveys. The entire dataset was merged to provide a 3D representation of the rivers surveyed.



For IAMHYDRO, a key element was showing the Bhutanese partners methods to conduct such studies themselves. With a huge potential of hydropower in the country, environmental assessments are an important requirement for future projects. The project focus in Bhutan was on fish; the Bhutanese want to develop sustainable hydropower in the country as they are aware of their environment and endemic species. The main fishes affected by hydropower are the local Snow Trout and Golden Mahseer as well as Brown Trout.



CEE HydroSystems were pleased to be able to support the bathymetry element of the project, and many thanks to Christian Haas, IAMHYDRO for photographs and case history details. To see the surveyors in action:

[WATCH THE VIDEO LINK HERE.](#)