

## How Deep is Lake Berryessa?

In the Spring of 2007, the Solano County Water Agency (SCWA) performed a survey of the underwater landscape of Lake Berryessa. They wanted to accurately determine the capacity of the lake using the latest technology. Siltation from a lake's shoreline is often a factor in lowering the total water-carrying capacity of reservoirs. SCWA wanted to investigate the sedimentation rate and establish a baseline as well as create accurate bathymetric maps.

The data used to make bathymetric maps today typically comes from an echosounder (sonar) mounted beneath or over the side of a boat, "pinging" a beam of sound downward at the lake bottom. The amount of time it takes for the sound or light to travel through the water, bounce off the lake bottom, and return to the sounder tells the equipment the depth at that location.

Of course, doing this from a moving boat requires a lot of calibration and measurement. The SCWA system used a motion reference unit, a gyrocompass, and attitude sensor for dynamic corrections for vessel movement. Deep water surveys can produce a large variation of sound velocity values due to thermal changes. Sound velocity casts were performed hourly to account for sound velocity changes through thermoclines. A "cast" is the process of slowly lowering a sensor through the water until it reaches the bottom. Then it is hoisted back to the surface. As the instrument runs through the water column, the sensor obtains conductivity, temperature, and pressure data.

For you techies out there, the list of survey equipment is fascinating:

A 26 ft. Research Vessel Sounder with Multibeam Sonar (300 kHz Dual-Head, Vertical Accuracy 1cm) 17 ft. Survey Skiff with Single-Beam Sonar (200 kHz Single Head, Vertical Accuracy 1cm). A Real-Time Kinematic (RTK) Global Positioning System DMS Motion Reference Unit and SG Gyrocompass Odom Sound Velocimeter

The Dual Head System has 125 beams per head with an across-track beam width of 1.5 deg. The system provides an approximately 200-degree swath coverage, or ten times depth. Maximum survey speed is 5 knots with sonar pings rate of 15 pings/sec.

The MultiBeam system was used for measurements in areas with depths greater than 10 ft. The SingleBeam system was used in shallow areas from 3 to 15 ft depths. MultiBeam and SingleBeam depth resolution was an amazing 1cm (0.4 in.) Each dual beam (set at 40 degrees) has 125 transducers and in ideal conditions provide a swath width that is 10 times the depth.

The Real-Time Kinematic (RTK) Global Positioning System survey data was used to merge the bathymetric data with the existing Napa County Digital Terrain Model (DTM) resulting in some astonishing visuals. Depth data is shown as color variations rather than contour lines. The survey results confirmed that Lake Berryessa retains its full capacity – which is now more accurately known. Siltation has not been a factor in reducing the total volume of water behind Monticello Dam.

