ESTIMATING THE STORAGE VOLUME OF WATER SUPPLY RESERVOIRS

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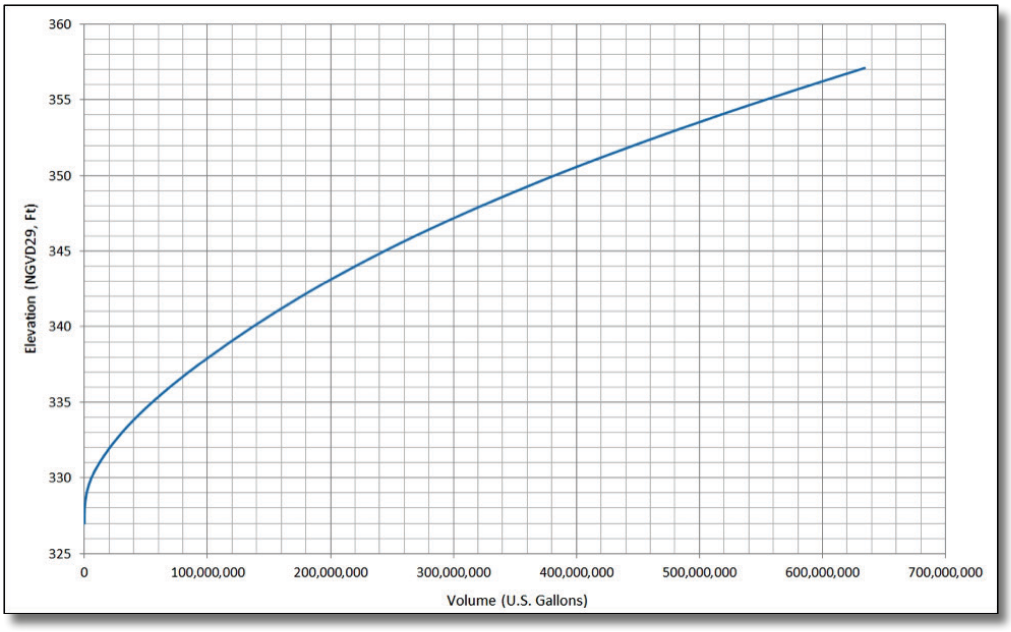
Recently, one of our circuit riders asked me a question that an individual asked him: how would an institution go about having the capacity of its fire-fighting supply pond certified to meet needs during a 50-year drought? This level of drought is one that occurs on average once in every 50 years (a 2% chance of occurring in a year). The institution requires this information for insurance underwriting purposes. The simple answer: have a professional engineer or surveyor do a study to determine this. However, I was not exactly sure what is involved with such a study and if you know me at all – that bothers me! Therefore, I decided to do some research and this study has led to this article. I decided to broaden the scope of the article to cover how the storage capacity of water supply reservoirs, including those used for drinking water purposes, is calculated.

Ultimately, the goal of an investigation into the storage volume of a reservoir is a graph like that shown below. It shows what the volume (capacity) of a reservoir is below a particular water elevation.



BATHYMETRY

Each reservoir will have a unique elevation capacity curve based primarily upon its bathymetry. Bathymetry is the underwater equivalent of topography. Whereas a topographic map shows the height of the land surface, a bathymetric map shows the depth of a water body. It is essentially a contour map of water depth measurements taken in the field at various locations. In the old days, water depths were manually measured using a pole or plumb line and horizontal locations determined using traditional survey instruments. Now, echo sounders and Global Positioning System (GPS) units are used. Highest accuracy is achievable using more sophisticated survey-grade sonar and GPS equipment. However, for some applications, a lower level of accuracy may be acceptable using recreational grade sonar ("fish finders") and mapping grade GPS units (horizontal accuracy of 0.5 -3 feet). In some instances, a recreation grade GPS unit such as those used to hunt and fish may be sufficient if it is equipped with WAAS (Wide Area Augmentation System). This system improves horizontal accuracy to approximately 10 feet.

GIS MAPPING AND CALCULATIONS

Contour maps of water depth measurements and a bathymetric surface model for the reservoir can be generated using Geographic Information System (GIS) software. GIS software can also calculate the volume of water within the reservoir at various surface elevations. An elevation capacity curve is constructed from these calculations.

FINAL THOUGHTS

A formal investigation of the storage volume of a reservoir may be something left to an engineer or surveyor. However, in my opinion, a water utility could undertake a simple study of a reservoir's depth. All that is required is a boat, a fish finder, and a hand-held GPS unit with WAAS capability. NYRWA may be able to help with the GIS mapping or you could contact your local soil and water conservation district or planning department. Feel free to give me a call at 1-888-NYRURAL, ext. 17 or winkley@nyruralwater.org if you have questions or are interested in learning more.