

MEASURING DIVERSIONS INTO SMALL RESERVOIRS



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STATE WATER RESOURCES CONTROL BOARD
August 22, 2016

11/04/2011

Goal of Question and Answer Session

- The goal of this session is to review ways to measure water diverted into small ponds and reservoirs.



Why Measure and Report?

- The implementation of improved measurement and reporting will:
 - Improve water right administration
 - Improve transparency of diversion records allowing the Board and all water users to more efficiently manage and use available water supplies
 - Improve the protection of public trust resources.

Livestock Registrations and Certificates

- Holders of livestock stockpond registrations and stockpond certificates:
 - Are generally not required to measure the amount diverted.
 - May estimate the monthly quantity of water diverted using their knowledge of the stockpond, weather conditions, ranching practices, and other relevant information.

Summary of Measurement Requirements for Storage in a Reservoir

Storage Amount (acre-feet)	Installation Deadline	Required Accuracy	Required Monitoring Frequency	Qualifications For Installation And Certification
50 af ≤ Storage < 200 af	January 1, 2018	15%	Weekly	Individual experienced with measurement and monitoring
10 af < Storage < 50 af	January 1, 2018	15%	Monthly	Individual experienced with measurement and monitoring

How to Calculate the Amount of Water Diverted to Storage

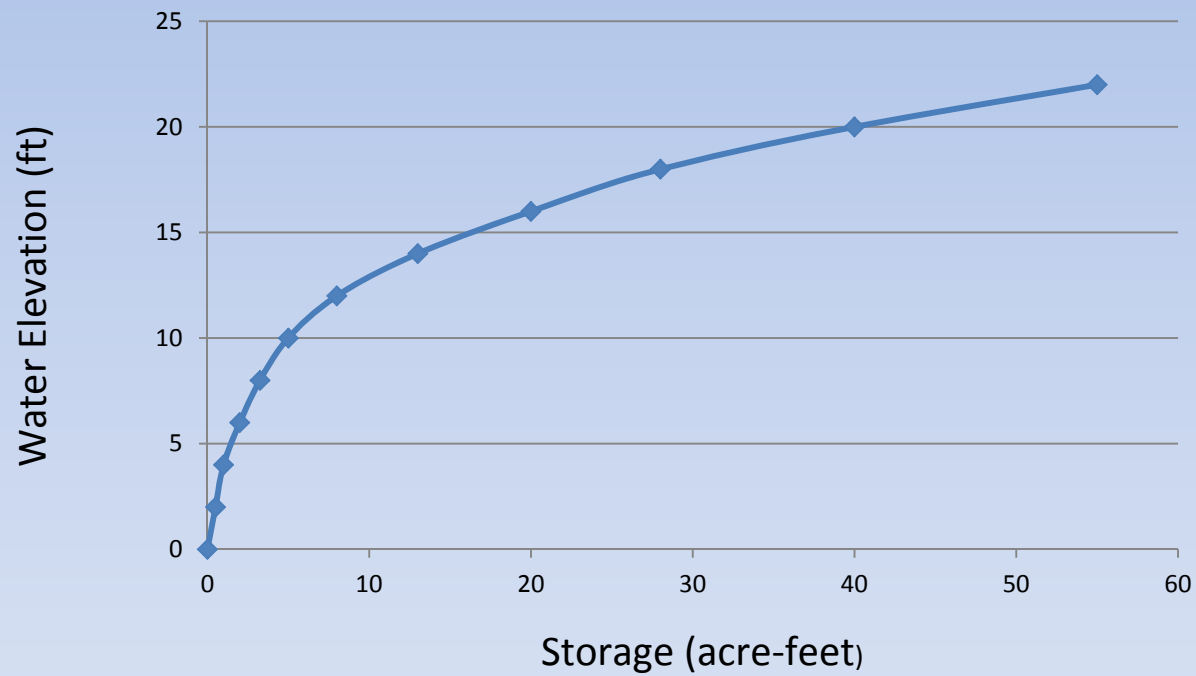
- The amount of water diverted to a small reservoir is equal to the change in storage during the monitoring period.
- Assumptions:
 - losses due to evaporation and seepage are relatively small compared to the amount of water diverted.
 - No water is withdraw from the reservoir during the monitoring period.

How to Calculate the Amount of Water Diverted to Storage

- A reservoir survey or other field measurements are necessary to develop the stage storage table.
- A stage-storage table is used to determine the amount of water stored in the reservoir based on the water level.

Stage-Storage Table and Curve

Stage (feet)	Storage (Acre-Feet)
0	0
2	0.5
4	1
6	2
8	3.25
10	5
12	8
14	13
16	20
18	28
20	40
22	55



Tracking the Amount of Water Diverted to Storage

Monitoring Period	Water Level Depth (ft)	Associated Storage (acre-feet)	Change in Storage during the Monitoring Period (acre-feet)
January	10	10	
February	15	18	+8
March	20	32	+14
April	19	29	-3
May	18	26	-3

Measuring Water Level

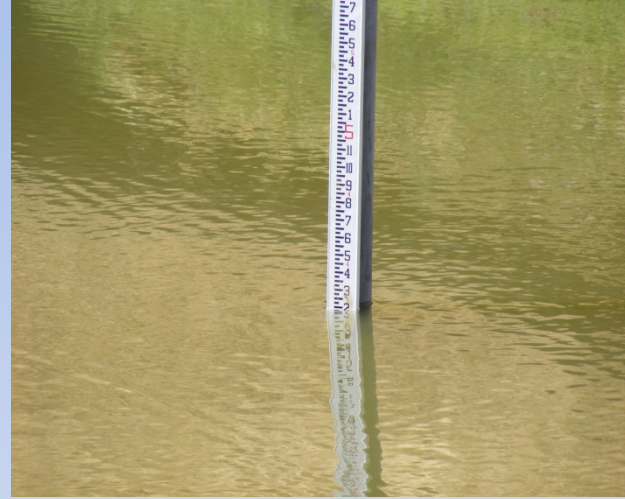
- There are a number of techniques for measuring water level in a small reservoir.
 - Staff Gages
 - Field measurement from known reference point or reference points.
 - Pressure transducers



Selecting Location for Measurement

- Site should be accessible, safe, stable, and convenient.
- Measurement device may be mounted to existing structure to reduce installation cost.
- Site must allow for ease of reading measurement device or downloading data from measurement device.

Staff Gages



STAFF GAGES

- A staff gage is a large, weather resistant ruler that is marked to allow for easy and accurate readings of water level.
- There are a number of vendors who sell staff gages.
- Staff gages may also be fabricated on-site for smaller reservoirs.

STAFF GAGES

- The staff gage must cover the operational range of the storage in the reservoir or pond
- A vertical staff gauge is the most common type.
- In some instances a sloped staff gauge may need to be installed if it is not practical to install the gauge vertically.

Homemade Staff Gage



Sloped Staff Gauge



Detail
Sloped Staff Gauge

Reference Points

- Water level may also be determined by measuring the distance to the water level from a known reference point.
- The reference point may be above or below the water line. For a reservoir, there will likely be a number of reference points.

Reference Points



Water Level Sensors

- The pressure sensor measures pressure due to the water column and the atmosphere.
- The pressure due to the water column is converted into an equivalent depth.
- A stage-storage table is used to convert the water depth into a storage amount.

Recent Improvements of Sensors

- Improved Battery Life – they will last multiple years.
- Improved durability and usability. Some units include the pressure sensors and the data logger.
- Improved user interface – USB compatible, Blue tooth, diode.

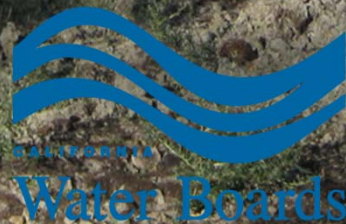
Choosing a Data Logger

- Issues to consider when choosing a data logger should include:
 - Compatibility with the measurement device
 - Non-volatile memory
 - Battery life
 - Process for downloading and viewing data
 - Weather resistance and durability
 - Cost versus manual measurement

Record Keeping

- Keep records of:
 - findings during site inspections.
 - Data used to calculate stage-storage relationship
 - Calculation made to develop stage-storage relationship
 - Data from the measurement device:
 - Data may be automatically recorded to a data logger or a log book may be maintained to record the water level measurements.
 - records shall be maintained for a minimum of 10 years

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