SOUTHERN NEVADA WATER AUTHORITY®

Water Quality in Lake Mead and Upstream Influences: Dissolved Oxygen during 2014

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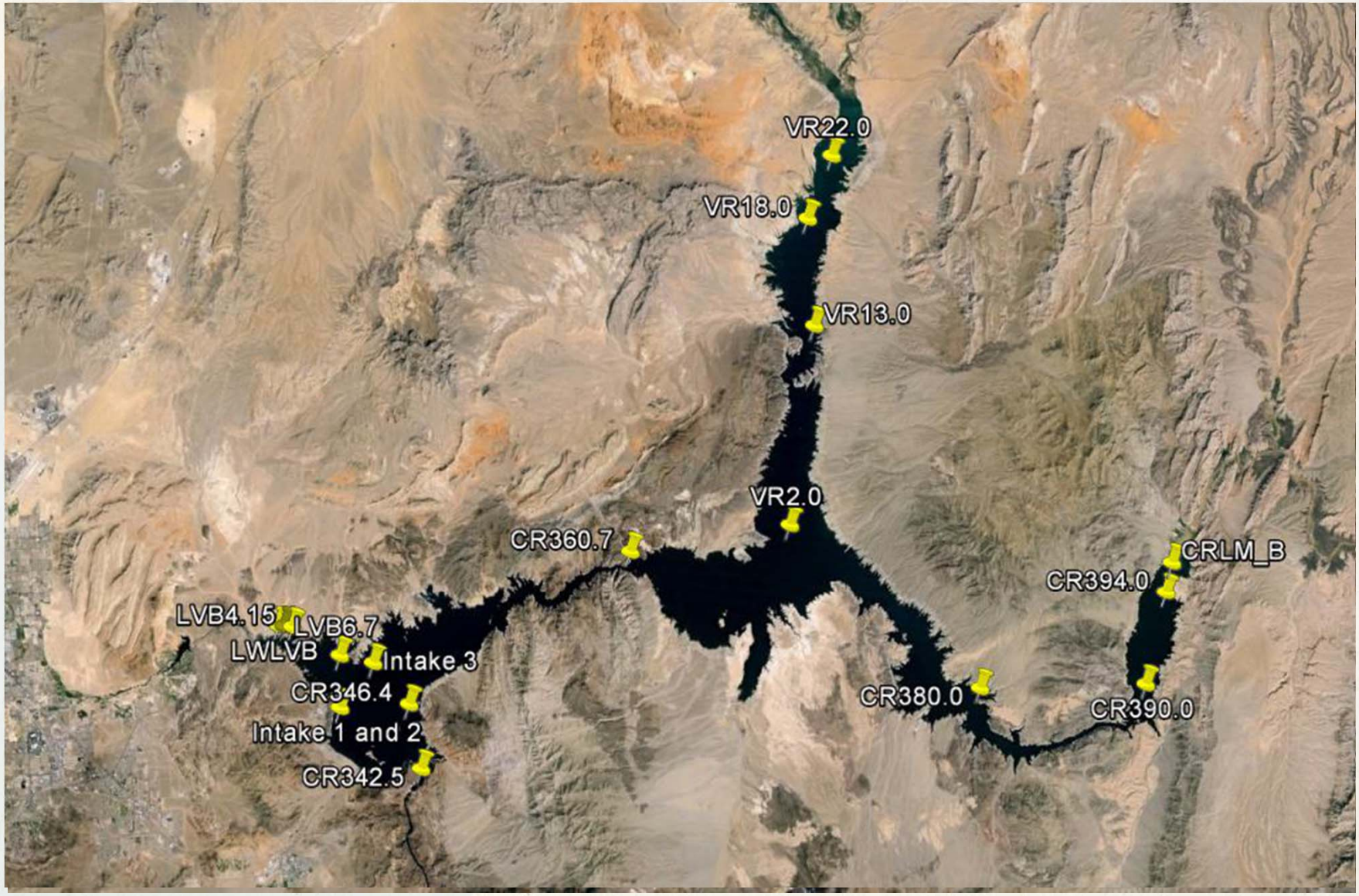
The Southern Nevada Water Authority

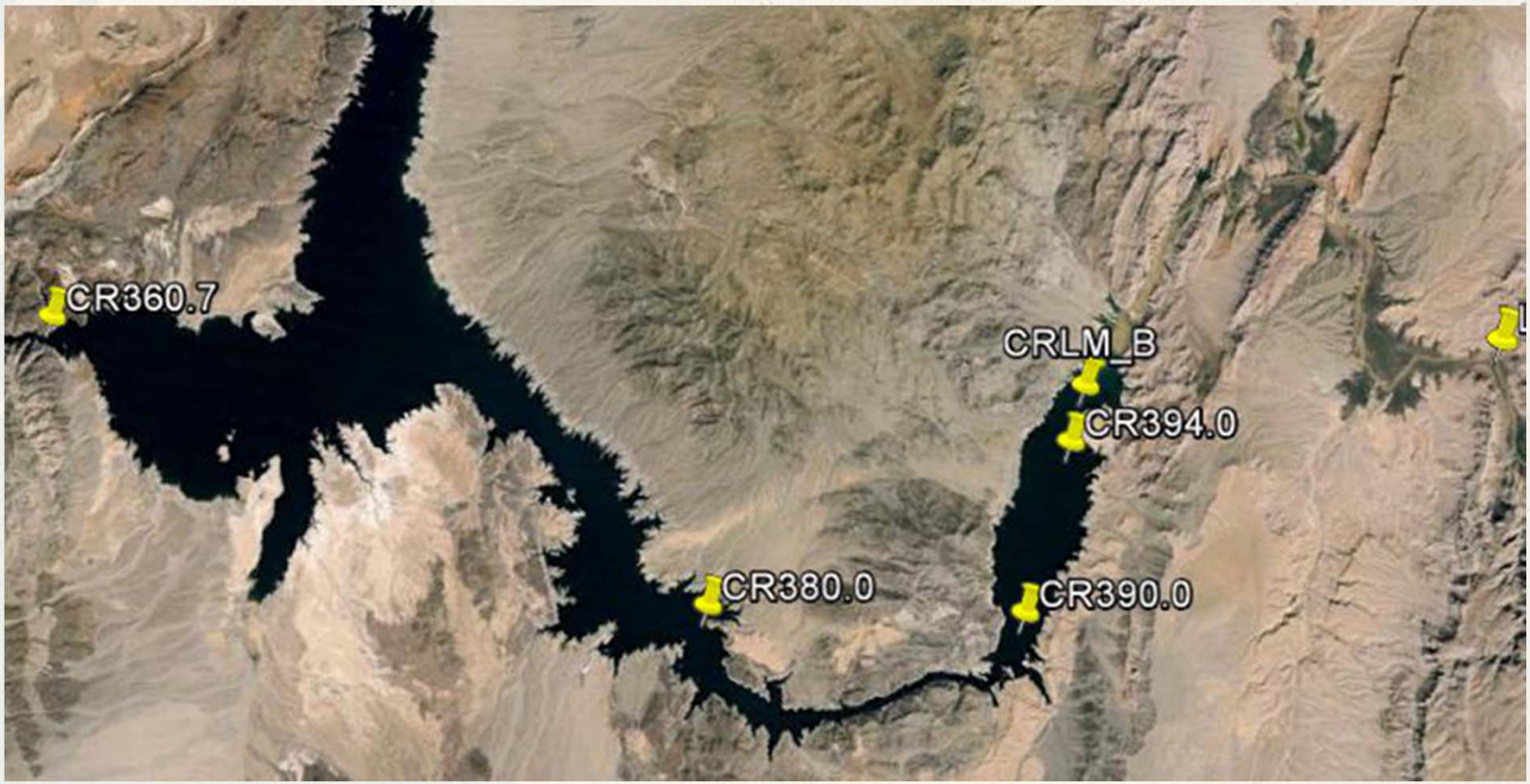
- Cooperative Agency founded in 1991
  - 7 members
    - Big Bend Water District, Cities of Boulder City, Henderson, Las Vegas and North Las Vegas, Clark County Water Reclamation District, and the Las Vegas Valley Water District
- Responsibilities
  - Managing all water supplies available to Southern Nevada through an approved water budget
  - Managing regional water resource management and conservation programs
  - **Ensuring regional water quality as determined by state and federal standards**
  - Allocating and distributing among water purveyors Colorado River water and any other water that becomes available to Southern Nevada
  - Long-term water resource planning
  - Presenting a unified position on water issues facing Southern Nevada
  - Building and operating regional facilities to provide a reliable drinking water delivery system to all member agencies

Lake Mead Sampling



Gregg Basin Sampling

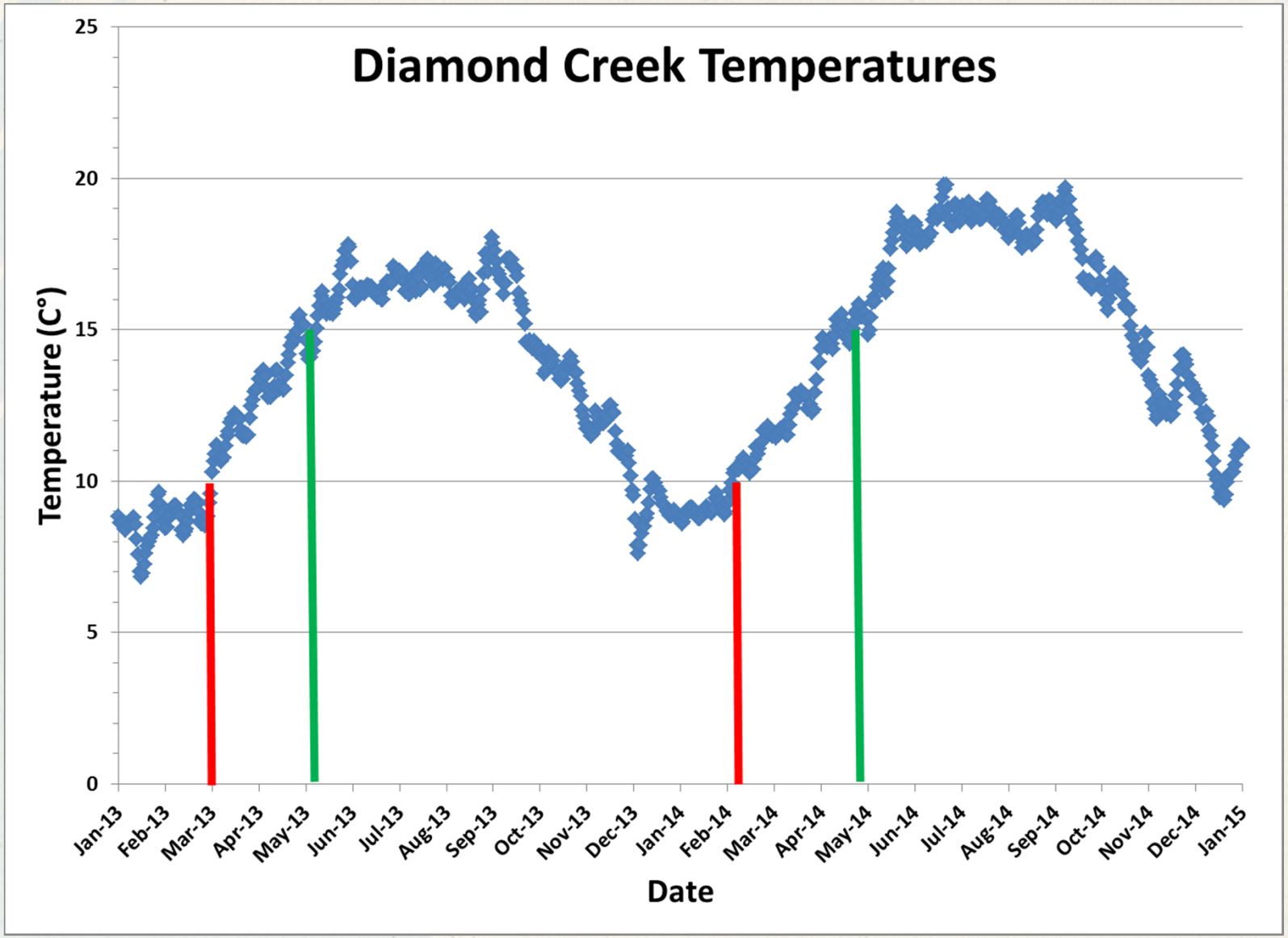
Hoover
Dam
~18 miles

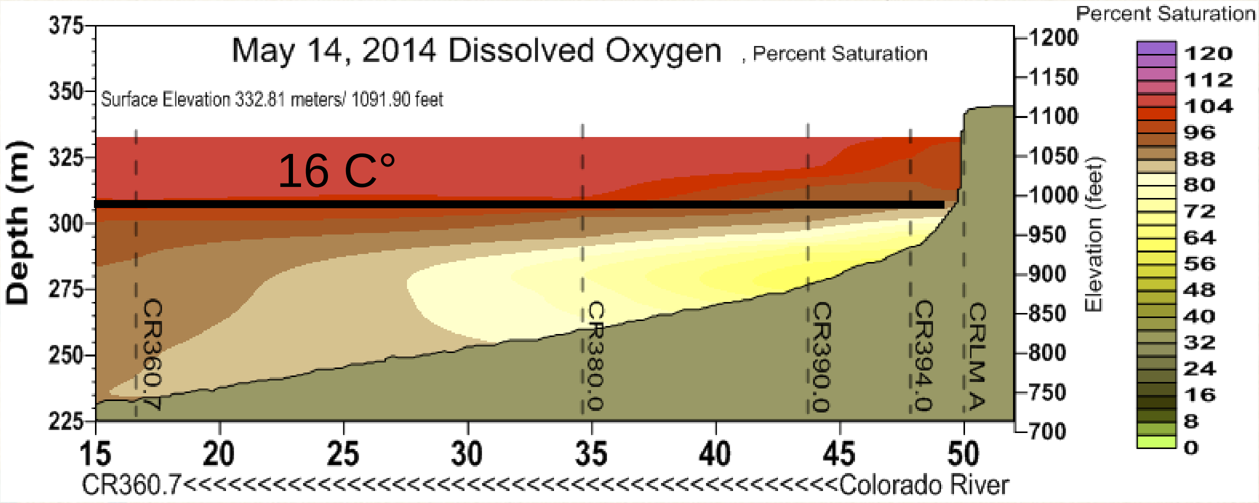


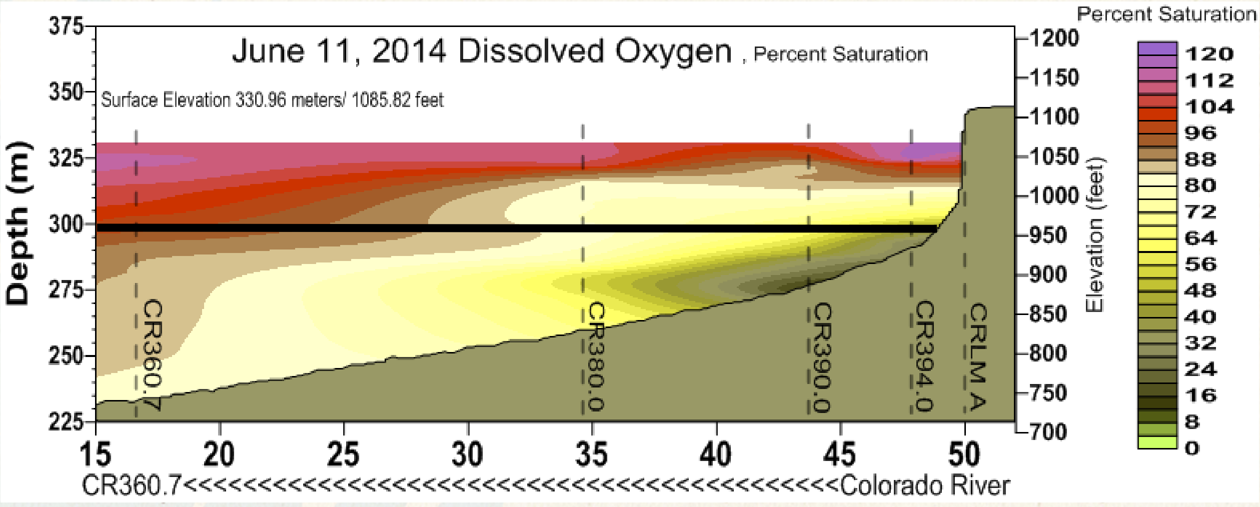
Why measure DO?

- We measure dissolved oxygen concentrations for a variety of reasons
  - Important indicator of ecological function
    - Most fish will thrive with oxygen concentrations of 4 mg/L (~40% saturation) or higher
    - When oxygen concentrations are below 0 and 4 mg/L most fish and aquatic organisms will experience significant physiological stress
      - Those that can swim away, will swim away
    - If oxygen concentrations drop below 1 mg/L most animals and plants that cannot leave will die (eventually depending on temperature)
  - While Lake Mead is only a moderately productive reservoir (in biological terms), the extensive bottom waters of the lake collect significant organic matter that is decomposed by microoorganisms, lowering the oxygen concentrations.
    - The temperature regime in Lake Mead and Southern Nevada allows Lake Mead to mix completely 1 out of every 2 years on average
    - When the lake mixes completely “new” oxygen is added back to the bottom waters
    - In the past, the conditions in the Colorado River have replenished much of the consumed oxygen during years without complete mixing
      - Cold River inflow
  - Oxygen is of interest to other stakeholders (LMNRA, NDOW, etc), there are water quality standard to be met, and the SNWA drinking water treatment process is optimized to treat oxygenated waters.

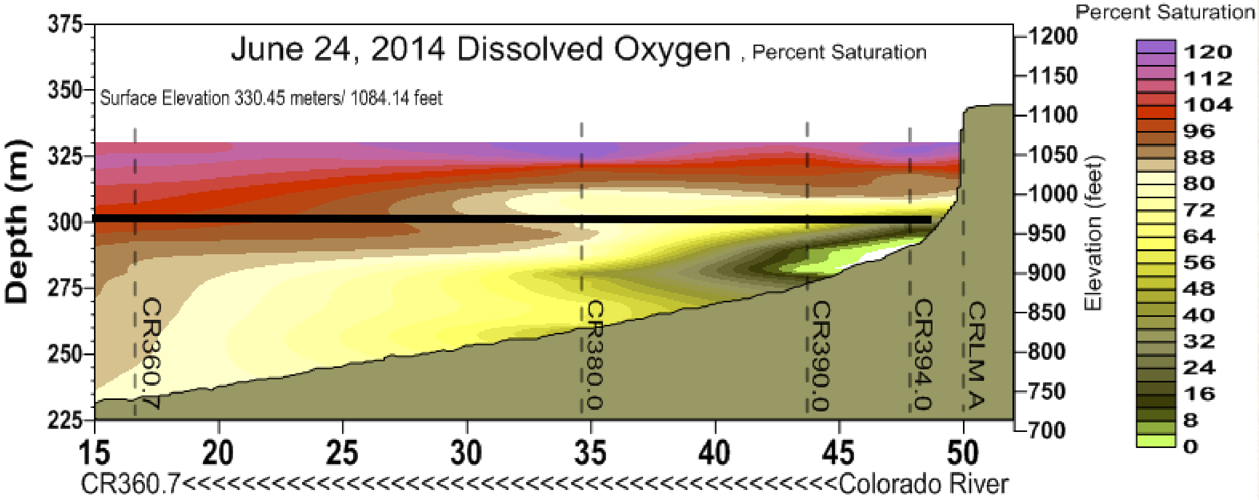
What makes 2014 interesting?

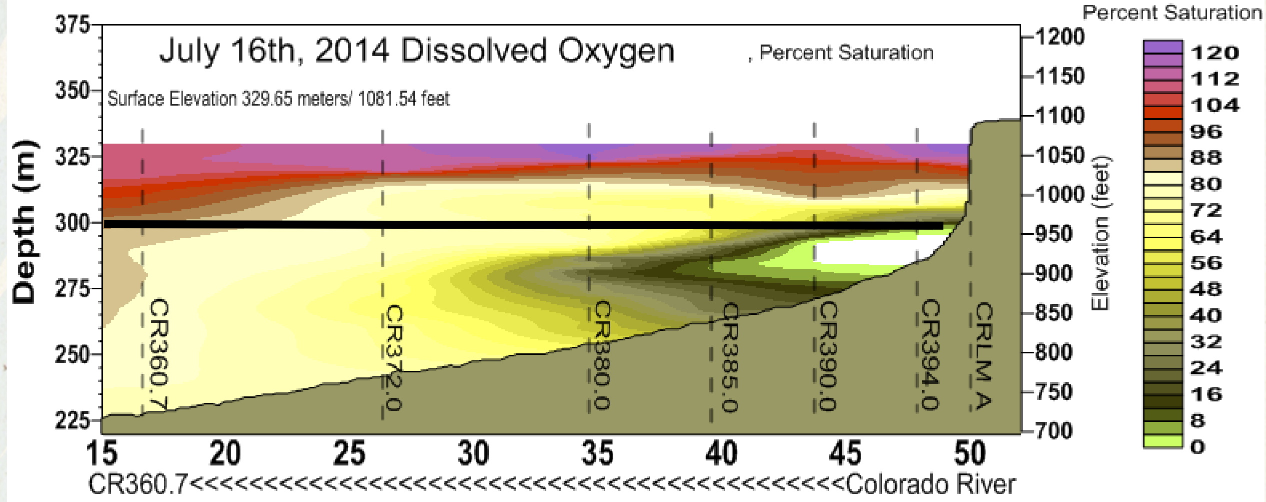




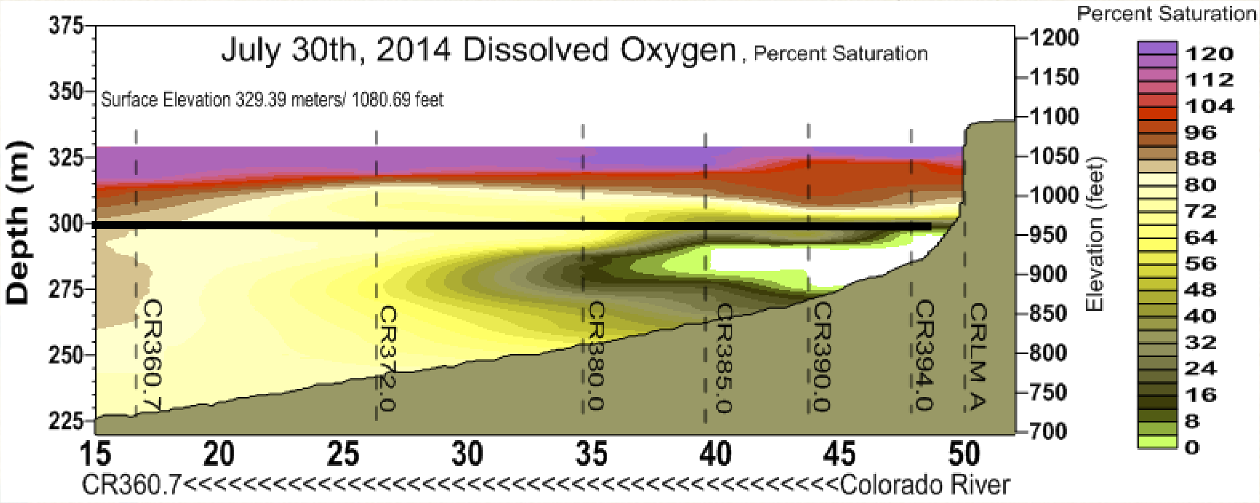


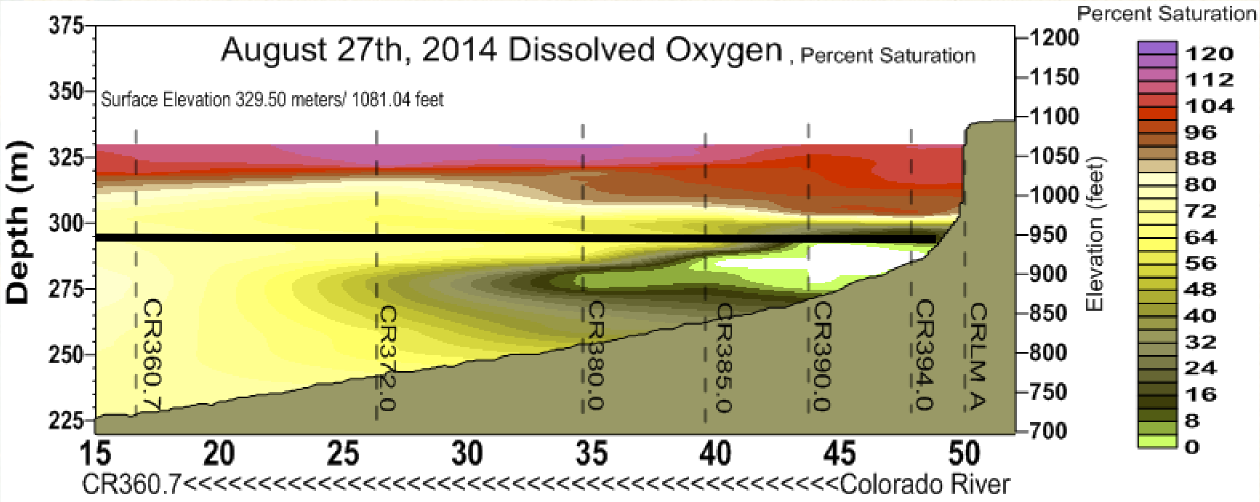
Gregg Basin 2014



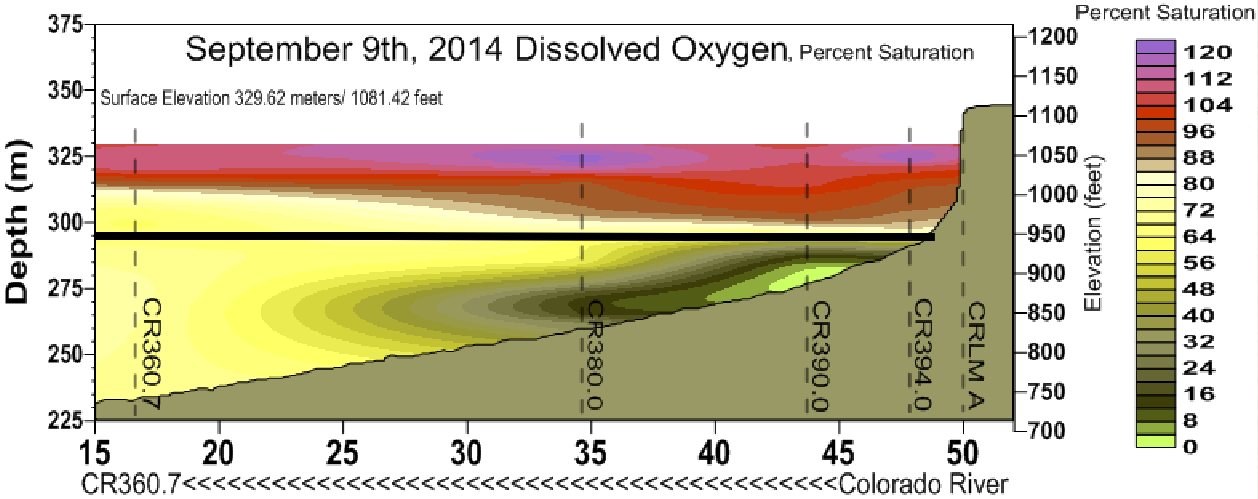


Gregg Basin 2014



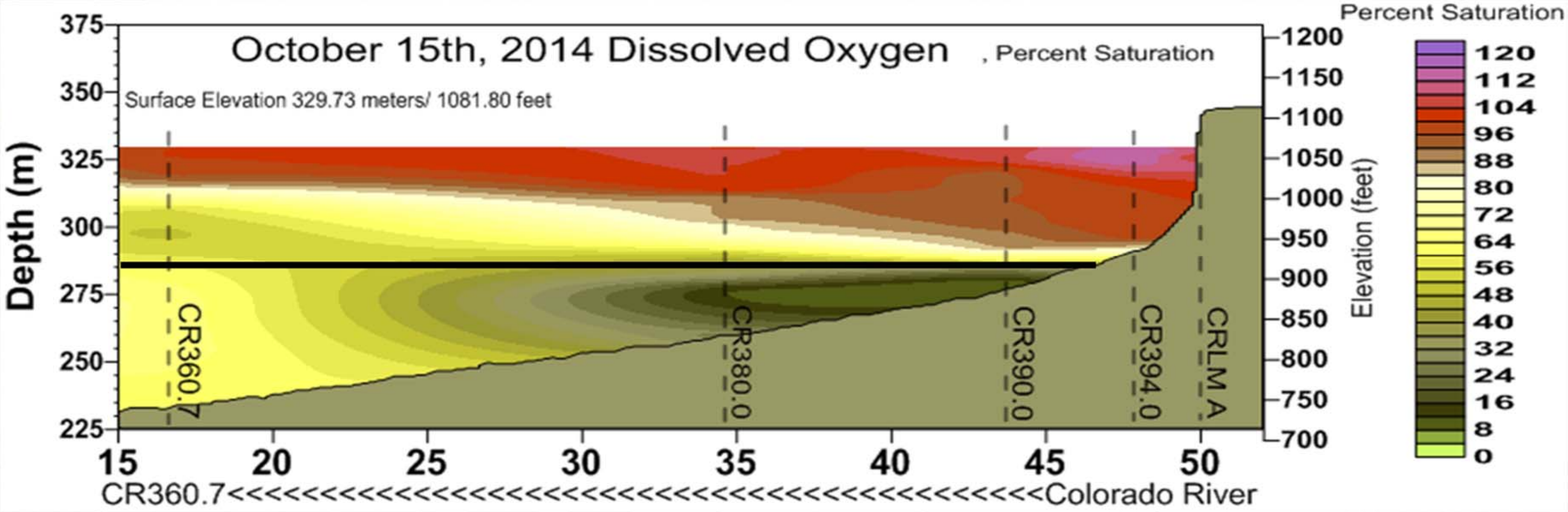


Gregg Basin 2014



September 9th, 2014 Dissolved Oxygen, Percent Saturation

Surface Elevation 329.62 meters/ 1081.42 feet

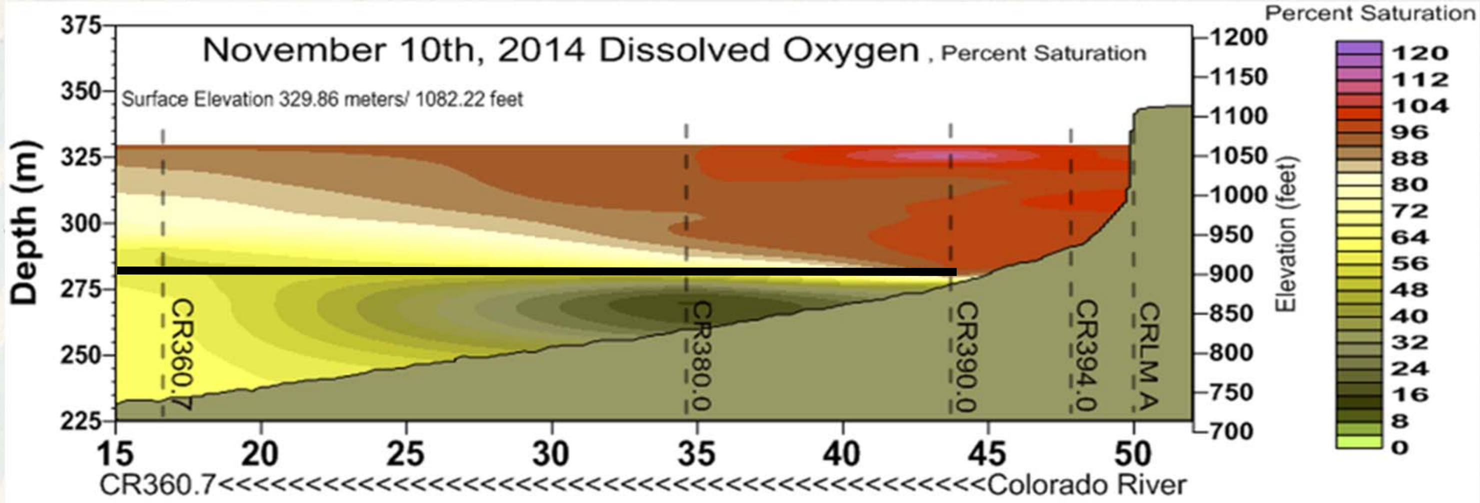


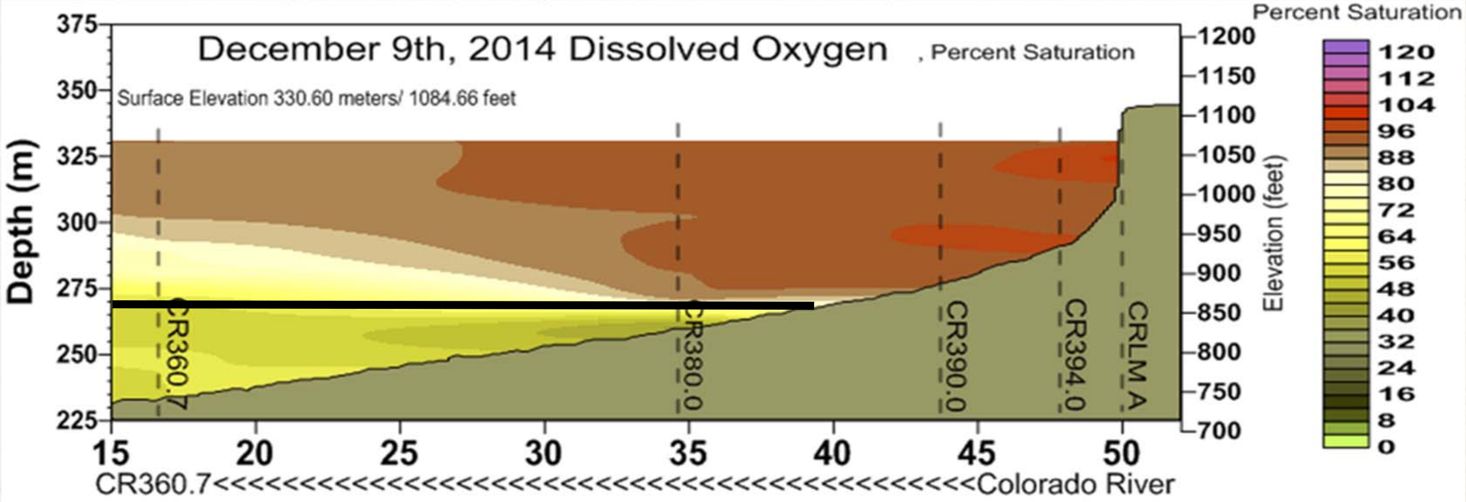
October 15th, 2014 Dissolved Oxygen, Percent Saturation

Surface Elevation 329.73 meters/ 1081.80 feet

Gregg Basin 2014

HFE
Starts

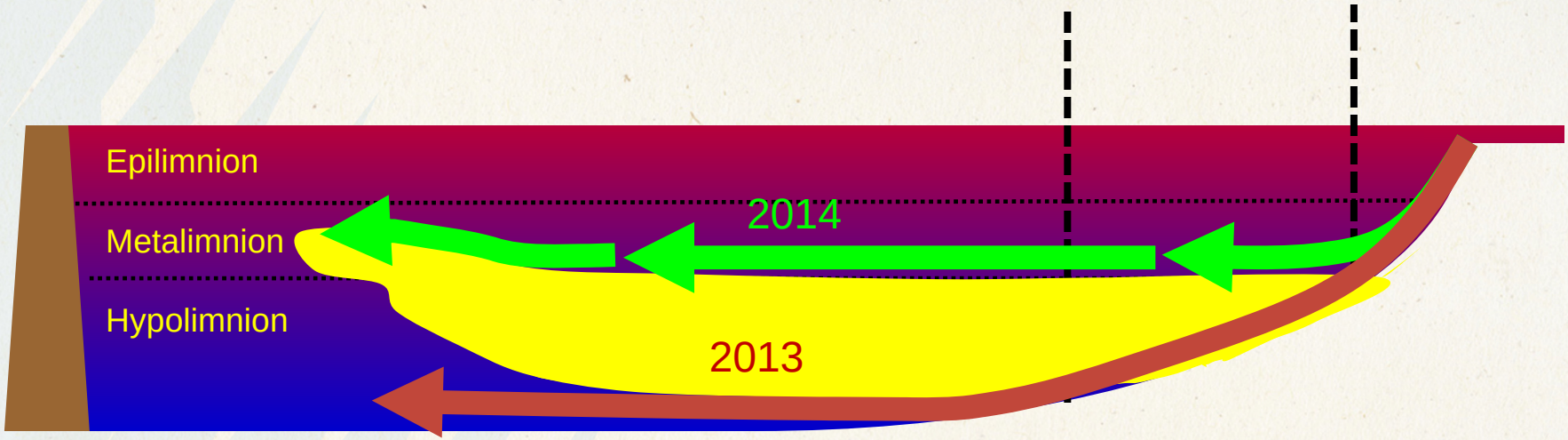




Gregg Basin 2014

Metalimnetic DO

Impact of Inflow temperatures on Lake Mead DO



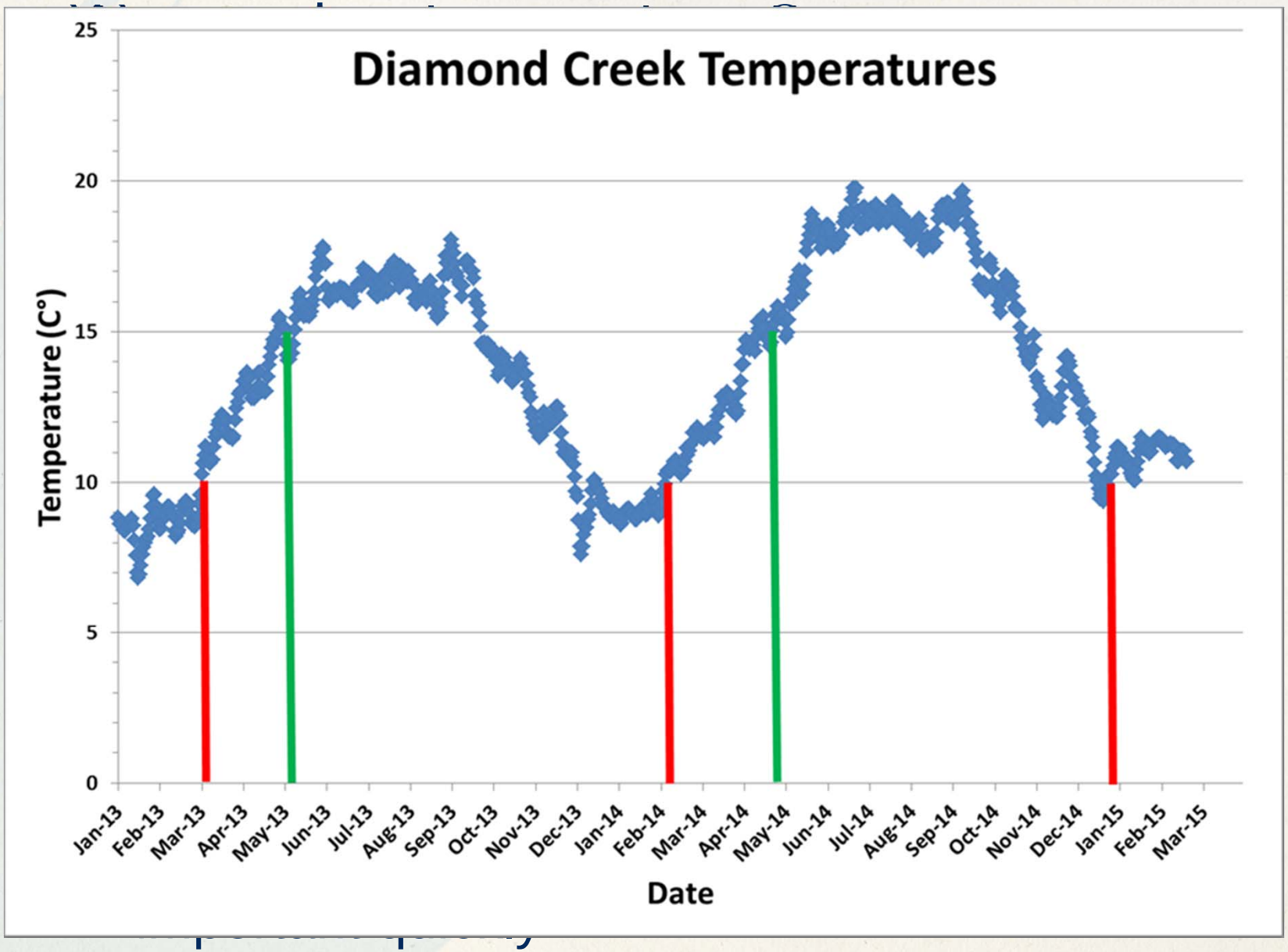
What have we seen in the past?

- USBR Technical Service Center collected data in this region of the lake for most of the 2000's.
- Low DO concentrations early, increasing later in the year
  - 2002, 2006, 2010
    - Similar to this year, likely overflowing CR
- High DO concentrations early, decreasing later in the year
  - 2001, 2005, 2011
    - Opposite of this year, likely cold inflowing CR
- High DO concentrations early and late, lowest mid-year
  - 2003, 2004, 2007, 2008, 2009
    - Partly cold inflow early, warming mid year, cooling late year

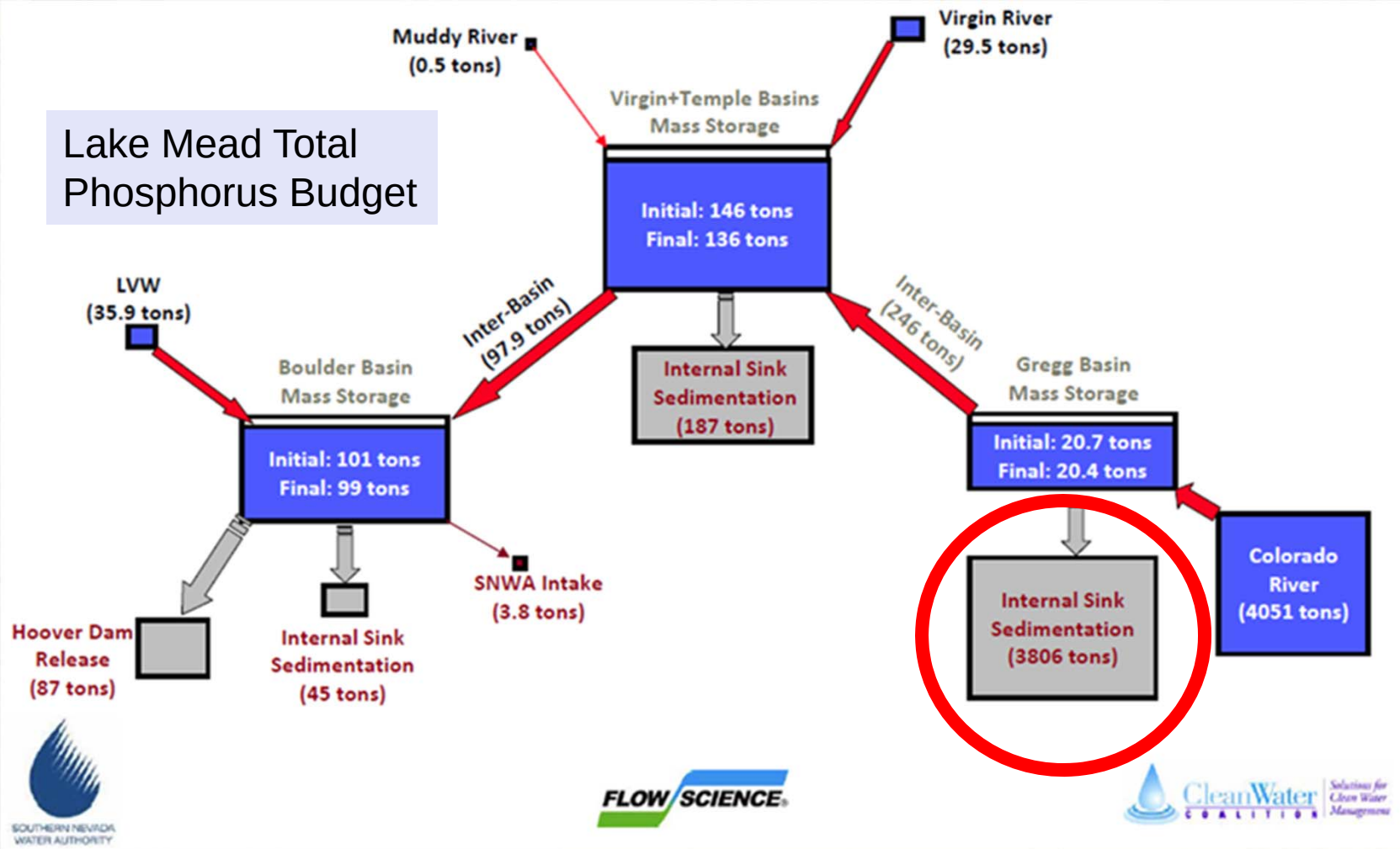
What does this tell us?

- The inflowing Colorado River can have a significant impact on DO dynamics in Gregg Basin, and the potentially the rest of Lake Mead
- The influence is not simple to predict
  - Need to consider
    - Lake Mead Stratification and Temperature
    - Colorado River Temperature
    - Algal Productivity in Gregg Basin
    - Hoover Dam operations
    - Timing
- We made a first attempt at this using the USBR data and failed
  - Temperature and Discharge were not enough alone

What can we expect in the future?



Biggest Potential Problem: Phosphorus Release



Conclusions

- Upstream temperatures can have significant impacts on dissolved oxygen concentrations in Lake Mead
- Cold river temperatures can alleviate or reduce low dissolved oxygen conditions
- Higher river temperatures keep the Colorado River water higher in the water column
  - Unlikely to re-oxygenate lower water column
  - May reinforce “natural” stratification patterns
- Significant, repeated anoxic conditions in upper Lake Mead have the potential to significantly alter phosphorus dynamics
  - Greater phosphorus release
  - Greater algal production
  - Greater anoxia

Questions?

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