Engineering & Operations Committee

Reservoir Management Update

Item 6b

August 15, 2022

Large Regional Source Water Reservoirs

- Metropolitan Reservoirs
- Dept. Water Resources
- Bureau of Reclamation

Reservoir Challenges

Water quality issues can reduce operational flexibility

Water Quality Issues

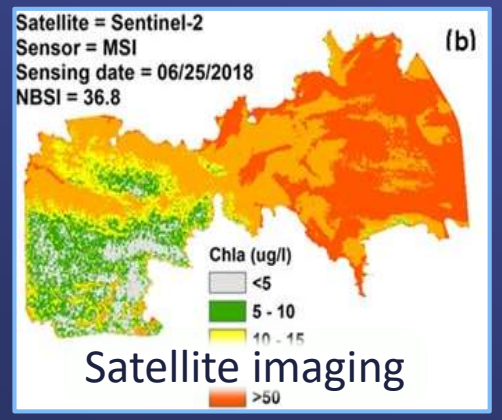
- Cyanobacteria "blooms"
  - Taste & odor (T&O) production
  - Toxin production
- Anoxia (low dissolved oxygen)
  - Elevated manganese
  - Hydrogen sulfide production
- Invasive quagga mussels
  - Restricts delivery options for infested CRW

Above the Lake, In the Lake, and In the Lab

Reservoir Monitoring Tools

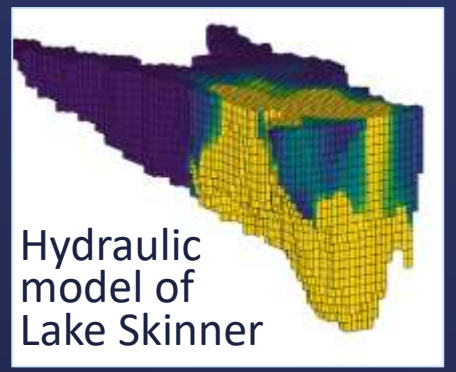
- Satellite monitoring of lake conditions
- Remote water quality sensors/probes
- Sampling and laboratory analyses
- Remotely operated vehicles (ROV)
- SCUBA diving
- Water quality models


Image credit: NASA



Satellite imaging


Microscopic cyanobacteria


Hydraulic model of Lake Skinner

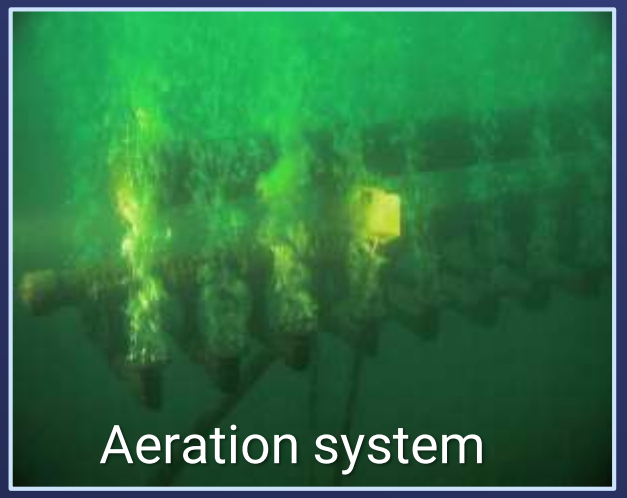
Lake Management Actions

Reservoir Management Toolbox

Managing lakes to ensure continued reliable water supply

- Cyanobacteria “blooms”
  - Tier change to avoid problem
  - Ozone at plants to reduce problem
  - Copper sulfate to eliminate problem
- Low dissolved oxygen (anoxia)
  - Aeration to mix water column
  - Deep water oxygenation (future)
- Quagga mussels (CRW)
  - Control through chlorination, cleaning, and controlled discharges

Copper sulfate treatment of cyanobacteria bloom



Aeration system

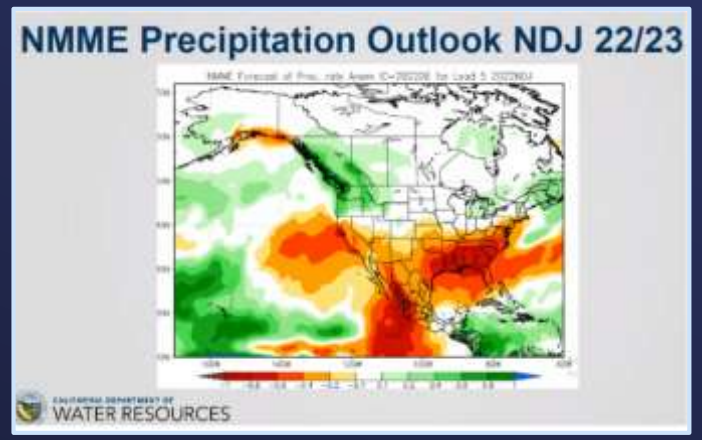
Historic Drought Operations

Water supply challenges:
- Constrain operations
- Require operational flexibility
- Impact water quality

California Precipitation (Water Year)

Period	Rainfall (inches)	Rank
1-year (2022)	16.65	13th driest
2-year (2021–22)	28.48	2nd driest
3-year (2020–22)	44.81	Driest by 4.45 inches


Lake Oroville



Low SWP allocation

- Third year of drought
- Record 3-year low SWP deliveries
- DVL supplying Mills Plant
- Dry conditions forecast to continue

Increased reliance on CRA

- Moving treated CRW farther into Metropolitan's system
- Operating the system in new and innovative ways

Diamond Valley Lake

810,000 acre-feet capacity
Only SWP supply since 2006

Typical water quality issues

- Cyanobacteria blooms
  - T&O, cyanotoxins (e.g., 2018)
- Anoxia and manganese

New Operation

- DVL supplying Mills Plant (2021-present)
- Over 75,000 AF delivered
- Tier changes when necessary to avoid water quality issues

Water Quality Issues and Operations

- Cyanobacteria blooms
- Low oxygen (anoxia)
- Manganese & sulfide


Lake Mathews Tower


Silverwood Lake


Castaic Lake Drawdown

- **Lake Skinner**
  - Tier changes to avoid deep-water manganese
- **Lake Mathews**
  - Outlet tower change for maintenance and cleaning
- **Silverwood Lake**
  - Supplies SWP water to member agencies on the Rialto Pipeline
  - Taste-and-odor issues
- **Castaic Lake**
  - Significant drawdown to support outlet tower seismic work

Quagga Mussel Discoveries in the State Water Project

- A few invasive quagga mussels discovered in SWP
  - Pyramid Lake- December 2016
  - Castaic Lake- August 2021
  - No veligers (larval stages) detected in routine monitoring of SWP- no evidence of widespread infestation
  - Currently no impact on water system operations

- Control measures still in place for all CRW sources
  - Chlorination, cleaning, controlled discharges

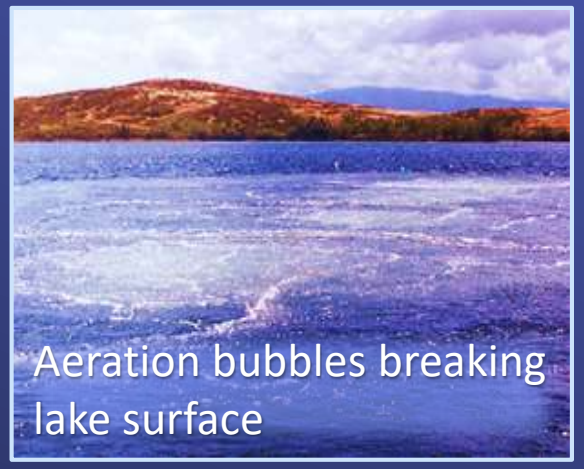
Photos courtesy of DWR

Improving Water Quality

Lake Perris

Water Quality Challenges
- Taste and odor
- Low oxygen (anoxia)

- Backup supply for Mills Plant when needed
- Current aeration system is inadequate
  - Does not prevent oxygen loss during summer and fall
- Engaging with DWR to design, construct and install new aeration system
  - Improve water quality
  - Increase operational flexibility



Aeration bubbles breaking lake surface

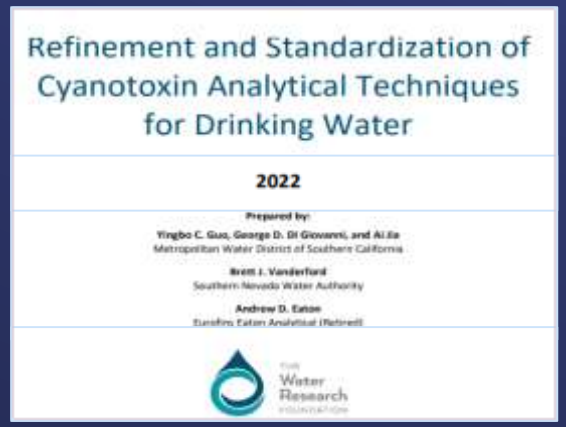
Aeration bar

Metropolitan's Monitoring and Research

- Year-round monitoring in source water reservoirs
- Event-specific monitoring when blooms develop
- Developing and improving detection methods

Cyanotoxins

- Not regulated in drinking water
- EPA Health Advisories
- State recommendations for notification levels
- Voluntary guidelines for recreational waters

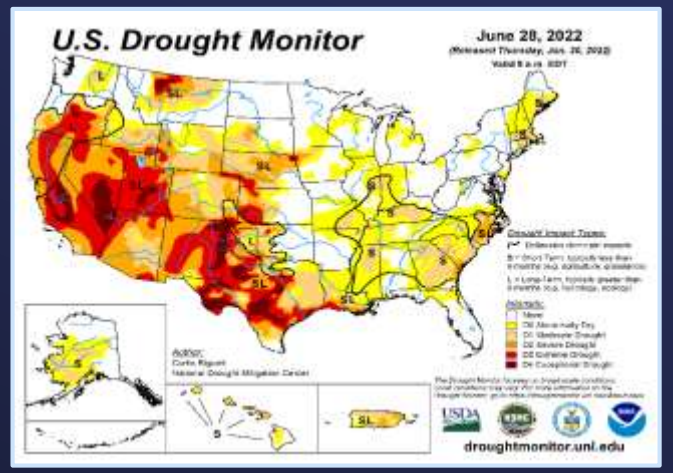


Recreational advisories typically do not impact drinking water

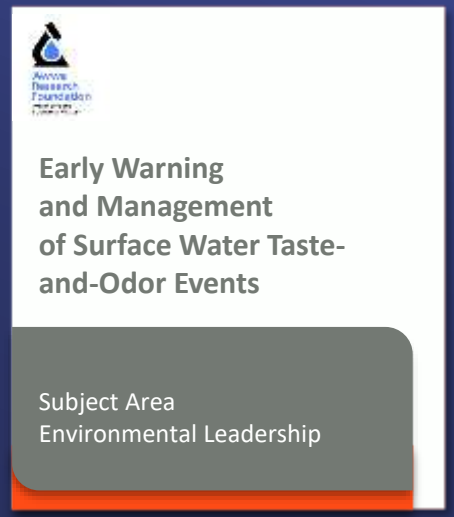
An Example of Things to Come?

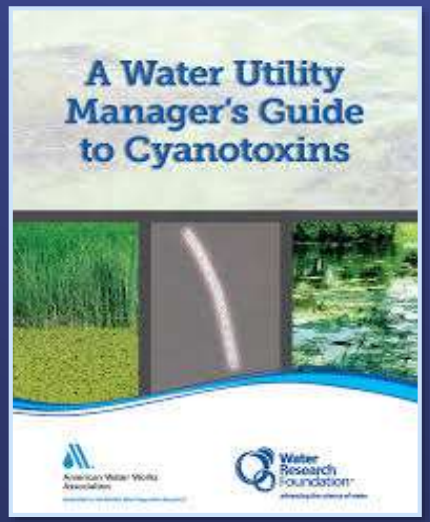
- Recent climate volatility could continue
  - A warmer, drier climate; reduced snowpack/runoff
  - Extended droughts on the SWP and Colorado River
  - Increased extreme weather events
- Potential for increased water quality issues
  - Increased turbidity from wildfires and storm erosion
  - More frequent cyanobacteria blooms
  - Increased spread of invasive species

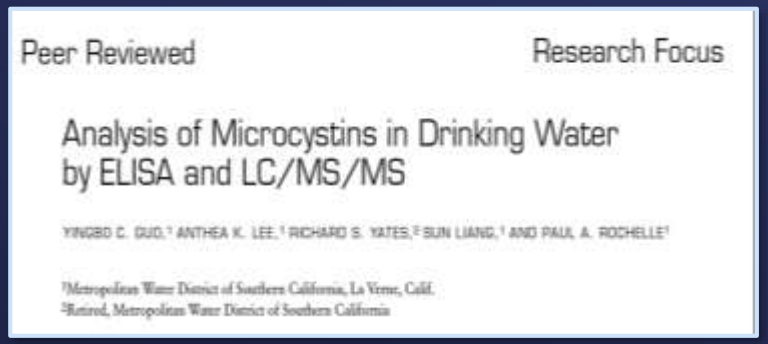
Current Drought Conditions



At the Forefront of Reservoir Management Science







California Lake Management Society. July 23, 2019

Application of Satellite Remote Sensing for Routine Monitoring of Water Quality in Water-Utility Lakes and Reservoirs

Presenter: Seyoum Gebremariam, PhD, PE

An Assessment of the Impacts of Climate Change on the Quality of MWD Source Waters and Reservoirs

Seyoum Gebremariam and Paul McCormick

(in preparation)

Looking into the Future

Drought conditions highlight the need for enhanced operational flexibility and require innovation in reservoir management

- Enhance monitoring of source water quality
- Improve and expand remote sensing
- Increase modeling and prediction capabilities
- Prepare for climate impacts on water quality
- Continue adapting lake operations to ensure reliable delivery and increase resiliency


THE METROPOLITAN WATER DISTRICT OF
SOUTHERN CALIFORNIA
1928