FALL 2022

CALMS

CALM Waters

Annual Newsletter of the California Lake Management Society

HTTPS://WWW.CALIFORNIA-LAKES.ORG/

CALMS 2022 Conference Oakland at CSU East Bay October 13-14

california-lakes.org/calms-conference



Loch Lomond Reservoir, Santa Cruz, CA. Credit: Jeremy Matthews

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CALMS 37th annal conference will be in person this year! CALMS 2022 Conference Information Join us October 13th for the conference, business meeting, and reception then return for a field tour of Temescal Lake on October 14th (transportation provided to and from the reservoir).

THANKS TO OUR SPONSORS!

CALMS appreciates the ongoing support of our sponsors.

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Buy some swag to support CALMS and our Student Scholars!

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34 CALMS OFFICERS & LEADERSHIP SUPPORT

CALMS would not be possible without the dedication of our Officers and Committee Members.

36 CALMS 2022 SPEAKER AGENDA

Check out the exciting speaker lineup for this year's CALMS Annual Meeting! There are concurrent afternoon sessions, so plan ahead.

37 WISHES FOR THE YEAR AHEAD

Wishing you and yours a healthy and happy year.

38 CALMS 2022 CONFERENCE OVERVIEW

Take advantage of all CALMS 2022 has to offer! Pre-conference happy hour, exciting presentations, and a field trip to Temescal Lake in Oakland!

PRESIDENT'S MESSAGE

by Mark Seelos, Ph.D., CLM (Valley Water) CALMS President 2022

s the world learns to live with the A whiplash of an unpredictably waxing and waning contagion, it is beginning to feel less like a pandemic and more like the new normal. Though this mental shift has been difficult for most, we in the western US are all too familiar with adapting to chaos, uncertainty, and change. Recordbreaking heat and flood events replace last year's records until they're no longer outliers. Drought emergency is declared so often that the term itself is starting to feel like a misnomer.

The climate of California's past is gone, sending our society discordantly down the five stages of grief. As most of us have arrived at acceptance, we are now faced with the untold sixth stage... what are we going to do about it? Like no one else, water managers have risen to the challenge.

Scientists model water quality and quantity under predicted climate scenarios so we can be prepared for future challenges. Agencies are proposing new ways to store the leftovers from water feasts to sustain us through the inevitable famines. Water conservation has become a way of life and point of pride. Together we have shown that our reservoirs are not half empty... they're half full.



We at CALMS are excited to bring our lake management community together this October, in person, for the first time since 2019 to inspire the collaboration that has made us so resilient. The great challenges that we face as lake managers require equally great solutions, and we are eager to reconnect and share ideas. We've lined up two concurrent sessions highlighting change and adaptation, and solutions to water quality problems. We have a record 6 student scholarship winners presenting the findings of their work. I'm looking forward to seeing everyone in Oakland for engaging presentations, networking opportunities, a reception dinner on Lake Merritt, and more!

CALMS 2022 IN OAKLAND - BACK IN PERSON! -**OCTOBER 13: CONFERENCE AND DINNER RECEPTION OCTOBER 14: MORNING FIELD TOUR OF LAKE TEMESCAL REGISTER HERE!**





37TH ANNUAL CONFERENCE



Thanks to everyone who participated in the 2022 CALMS photo contest!





2022 CALMS Webinars: Virtual Classics!

Replays of our 2022 Webinars can be found at the links below:

Learn about the California **Bioaccumulation Monitoring Program and** Safe to Eat Workgroup!

Learn about Assessing **Reservoir Re-Operations** to Improve Aquatic Habitat!

Doug Chalmers discusses ways to improve aquatic habitat using reservoir re-operations:

https://www.youtube.com/watch?v=xd qyudB0WYQ



Anna Holder from SWAMP discusses the CA **Bioaccumulation Monitoring Program!** https://www.youtube.com/watch?v=bEPgwRmwgYc





John Moynier discusses climate change, its impact on water supplies, and how communities are preparing. https://www.youtube.com/watch?v=cly5ldotOyw

Learn about using forecast informed reservoir operations to help deal with climate change including environmental, social, flood protection, and hydropower energy impacts!



by Eli Kersh, Lake Tech North American Lake Management Society Region 9 Representative: AZ, CA, HI, NV https://www.nalms.org

vou can do it from a boat, you can do it from a float. You could dip-in here or there. Hey, you can dip it anywhere!

It's a round, white disk used in the sea to measure transparency. The Secchi Disk, so it's named, after an Italian dude who's quite acclaimed. Yup you guessed it, the Reverend Father Angelo, but there's one important fact you really need to know.

There was once a professor named George C. Whipple, who realized reservoir transparency just wasn't as simple. The ocean, you see, is deep and black, but lakes as you know, are full of crap. So George painted the disk both black and white to provide more contrast in low light. In 1914 he wrote the book, and that's where our disk gets its modern look.

Then along came Carlson with his TSI, who took the disk to an all new high. When you multiply measured depth by the natural log, you'll know when the lake will become a bog. Oligo, Meso, or eutrophic state, now that's what makes the Secchi Disk so great!



NALMS UPDATE

NORTH AMERICAN LAKE MANAGEMENT SOCIETY



So, lower your disk till it disappears then track results over many years. There's still time to participate in the #SecchiDipIn for 2022 and get out on the water to enjoy #LakesAppreciation month!

#LakeLocker #LakeTech #lakemanagement #pondlife # waterquality

Please direct questions to Eli Kersh (region9@nalms.org)







Across

- 2. Tallest Dam in the USA
- 8. Increases with ionic strength.
- **10.** President Vacuum Cleaner Dam
- **11.** Pressure proportional to the depth of overlying water.
- 14. The largest water use in California.
- **15.** Aquatic plants visible to the human eye.
- **17.** Saltiest lake in the USA that hit historically low volume in 2022.
- **18.** Generally considered a more stable indicator of fecal coliform than E. Coli.
- 19. Includes Oroville, Del Valle, Castaic, and Perris
- **20.** Purple pipe water is

KEY TO PUZZLE ON PAGE 30

Down

- **1.** Inflows and outflows are added to hydrodynamic models as:
- **3.** California spends \$3 million a year attempting to eradicate this large rodent.
- 4. Land Locked Lake
- 5. Includes Shasta, Folsom, and Friant
- **6.** The Third Straw intake tunnel was constructed to withdraw the last bit of water from this reservoir.
- 7. A strong vertical chemical gradient
- **9.** Invasive species with the largest impact on aquatic systems.
- **12.** Alkalinity is commonly measured by:
- **13.** Replace your lawn with _____ landscaping
- **16.** Monster living in Lake Tahoe

IN LOVING MEMORY OF JERRY GOAD

CALMS IS HONORED TO CELEBRATE THE LIFE OF JERRY GOAD, WHO SHARED HIS LOVE OF LAKES WITH FUTURE GENERATIONS

e are delighted to support the student scholarship program through CALMS in honor of our Dad, Jerry Goad. Our Dad loved fishing the lakes of California and delighted in teaching the hobby to his two daughters and his three grandsons. Jerry was born in Elvins, Missouri and made his way to California in 1963 with his wife to begin a life of opportunity in a new place. He was always good at figuring things out and repairing just about anything. He



had a long career as a trailer mechanic and what he loved most was spending time with family and getting out on the rivers and lakes to fish. When he retired, he moved to the Sierra Foothills to be closer to fishing and to be near his grandsons. He was a friendly, helpful neighbor, a community man and a fixture at his grandson's athletic events as they grew up. He was everyone's Pop. In the Fall of 2012, he was diagnosed with Lymphoma and fought courageously for 9 years. He passed away quietly on 10/13/2021 and will forever be missed by his wife of 61 years, family and friends. We are grateful to honor his memory by supporting research into the lakes and waterways he enjoyed so much. On behalf of our family, congratulations to the 2022 scholarship winners.

NAIVY D. RODAL MORALES Mercury cycling in hodges reservoir before and after

HYPOLIMNETIC OXYGENATION

Jerry Goad Memorial Student Scholarship Recipient

odges Reservoir is a source of raw water for potable treatment by the Santa Fe Irrigation District and a backup water supply for the City of San Diego. Eutrophication, due to external and internal nutrient loading, results in anoxic bottom waters and the release of problematic substances including ammonia, phosphate, iron, manganese, sulfide, and toxic methylmercury from profundal sediment. The concentration of these substances increases during summer months when the hypolimnion becomes severely anoxic due to thermal stratification. A hypolimnetic oxygenation system (HOS) was implemented in 2020. My study aims to evaluate if the implementation of HOS is repressing the liberation of these compounds while lower mercury bioaccumulation and improving eutrophic conditions of the reservoir. Data analysis includes the comparison of pre-oxygenation data (2017-2019) with the two years of postoxygenation (2021-2022). I will use a 1-D model using the information collected at a deep-water station that includes a transport equation based on the heat-accumulation method. The model will predict the transport of nutrients, metals, and mercury across the thermocline before and after oxygenation. Moreover, I will calculate the areal accumulation rate in the hypolimnion of the compounds pre- and post-oxygenation. Results from preoxygenated years showed high accumulation rates of ammonia (187 mg/m2-d), manganese (24 mg/m2-d), methylmercury (23 ng/m2d), and sulfide (699 mg/m2-d). Preliminary post-oxygenation results show a decrement



in the accumulation rate of ammonia (21 mg/m2-d), manganese (-12 mg/m2-d), methylmercury (-0.24 ng/m2-d), and no H2S odor, levels associated with more oxidized conditions. I am still conducting laboratory analyses and field work this summer. Initial results suggest that HOS is restoring the bottom water oxic conditions of the lake and improving water quality.

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UC Merced PhD Student Environmental Systems, School of Engineering Advisor: Marc Beutel



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KANARAT PINKANJANANAVEE DEVELOPMENT OF A LOW-COST IN SITU CYANOBACTERIA SENSOR

AquaTechnex Student Scholarship Recipient

armful algae blooms have been increasing throughout the globe. The cyanobacteria grown in such events not only deteriorates the health of the water body but also generates harmful cyanotoxins. To prevent and study these events, many organizations have been using in vitro techniques, such as microscopic investigation, to quantify cyanobacteria concentration. However, these techniques are highly complex and time consuming and can't be used for an instantaneous assessment of bloom events. Which leads to my proposal to use high-resolution in situ fluorescence technology monitoring. These fluorometers detect the emission of a fluoresce cyanobacteria pigments, to identify the concentration of cyanobacteria in the water body, making this technology an essential device in cyanobacteria detection and research. However, the high retail price of these in situ fluorometers has limited their availability to both students and researchers. I am part of a collaboration between UC Davis and US Bureau of Reclamation to develop a low cost in situ cyanobacteria fluorometer sensor to improve the understanding of the cyanobacteria bloom events and provide a warning system for potential cyanobacteria bloom events. The sensor was developed by using the Arduino MEGA as the main processor, Hamamatsu C12880MA as an optical receptor, and UV-C LED lamp as the excitation light sources. In summer 2022, two networks of five sensors will be deployed at two different reservoirs. The first network will be deployed at San Luis Reservoir and the second network will be deployed at



Stampede Reservoirs. The sensors will be collecting data hourly and recovered after 4-6 weeks of deployment for data extraction and then redeploy throughout the summer of 2022. The data collected with developed sensors will be used in correlation with grab samples to improve the sensor's accuracy and reliability. The method one day may provide reservoir managers with warning of possible bloom events and allow them to initiate bloom prevention procedures.

UC Davis PhD Student Civil and Environmental Engineering Advisors: Alex Forrest & Thomas Young



Drought is a way of life in Santa Clara County.



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RUTH THIRKILL

WHAT LIES BENEATH: THE UNREALIZED METHANE POTENTIAL **OF MEDITERRANEAN CLIMATE RESERVOIRS**

Vallev Water Student Scholarship Recipient

cross all climate regions, reservoirs play 🖰 an important, yet poorly understood role in the generation of greenhouse gases (GHGs). Over the past year, I have conducted echo sounder sediment surveys and measured carbon flux rates from three northern CA reservoirs. Water quality measurements taken concurrently with the gas flux measurements show that strong correlations exist between methane emissions and both chlorophyll-a and water temperature. The objective for this summer's field plan is to collect high-resolution chlorophyll-a data using an Autonomous Underwater Vehicle mounted with a Seabird CTD sensor and a WETLabs fluorometer. The AUV missions will be designed to have the vehicle run at a constant depth of 1 m below the lake surface and collect spatial fluorometer data across a transect in each of the reservoirs. These new missions will coincide with the acoustic sediment surveys and cross reservoir gas sampling to determine any correlations between the three datasets. The critical outcome is not just to quantify methane emissions but to holistically investigate the meteorological, physical, biological, and chemical drivers that govern methane efflux. The final goal is to create a data-driven model depicting the concentration of carbon gas along the reservoir's floor to quantify the spatiotemporal variability of methane evolution in California reservoirs.

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UC Davis PhD Student Civil & Environmental Engineering Advisors: Alex Forrest & Holly Oldroyd

CORRIN CLEMONS

OUANTIFYING METHANE RELEASE VIA EBULLITION AND DIFFUSION

IN UVAS RESERVOIR

Student Scholarship Recipient

ethane emissions from reservoirs have been historically underestimated since they exclude the process of ebullition. To better understand, quantify, and model methane ebullition, I will conduct field research during summer 2022 to measure methane emissions from Uvas Reservoir in Santa Clara County, California. Measurement methods will combine analyses of reservoir bathymetry, sediment composition and gas content, water quality, surface emissions via ebullition and diffusion chamber measurements, and net emissive fluxes via eddy covariance. While many of the other parameters have been measured over the past year, eddy covariance measurements will be added to this study over the summer to produce a complete methane emission profile. For this to occur, an eddy covariance tower and floating platform on which it will stand on the reservoir must be constructed and deployed on the water. Tower design and instrumentation is in progress and include a methane analyzer and will sonic anemometer in addition to devices measuring other metrological parameters used to ultimately estimate the flux of methane through the air column. Tower construction will begin towards the end of the spring quarter; deployment and sampling will begin in June and continue through September, when greenhouse gas emissions are expected to be the greatest. Because data acquisition is mostly automated, once



the station is fully operational, regular maintenance will be necessary to verify that continuous measurement is unhindered over the summer. Data analysis will be performed as data is obtained and continued into the fall.

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UC Davis PhD Student Civil & Environmental Engineering Advisor: Holly Oldroyd

JULIANNA PORRAZ UNDERSTANDING PATTERNS OF CARBON DIOXIDE RELEASE

FROM UVAS RESERVOIR

Student Scholarship Recipient

tmospheric greenhouse gas emissions (GHGs) contribute to climate change, a global phenomenon resulting in long-term adverse effects. Reservoirs are hotspots for methane and carbon dioxide fluxes that are released into the atmosphere; however, there is little knowledge about the drivers of carbon dioxide and the impact that spatial and temporal variability play in flux emission rates. Preliminary results show strong diurnal variability in both methane and carbon dioxide, with peak flux rates generally occurring during the daytime for methane and during the nighttime for carbon dioxide. For example, in June 2021 at Uvas Reservoir, methane emissions increased from 0.056 mg/m2·h at night to 0.82 mg/m2·h during the daytime, while carbon dioxide emissions decreased from -32.6 mg/m2·h at night to -64.7 mg/m2·h. These fluxes are also variable seasonally, where strong seasonal trends in methane flux rates with peak emissions occurred during the warmer summer months when the reservoir bottoms had low dissolved oxygen concentrations and oxidation-reduction potential. Studies show that reservoirs can act as either a strong source or a sink for carbon dioxide. Due to the lack of knowledge about carbon dioxide, it is currently difficult to estimate the global emissions from reservoirs. This leads to inconsistent predictions of global climate models. My goal for the expansion of the project is to start analyzing carbon dioxide



and gain knowledge of the spatial variability of carbon dioxide fluxes from drawdown sediments. In Summer 2022, I will further observe the role Mediterranean reservoirs, such as Uvas reservoir, have on carbon dioxide flux concentrations and discover the main drivers and mechanisms of the surface gas fluxes.

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UC Davis PhD Student Civil & Environmental Engineering Advisors: Holly Oldroyd & Alex Forrest

EMILY SNIDER

PREDICTING FUTURE MAXIMUM PRECIPITATION AND FLOODING EVENTS

IN THE AMERICAN RIVER

Student Scholarship Recipient

limate change has the potential to impact global atmospheric mechanisms, possibly altering extreme precipitation events and thus, the hydrologic response and resulting lake management techniques. Probable maximum precipitation (PMP) and probable maximum flood (PMF) have long been used as estimates of the physical maximum precipitation and flooding an area can expect. Historically, these estimates have relied on past extreme event observations and statistics, but this methodology may not be reliable under a changing climate. For this reason, a novel PMP and PMF methodology has been developed and will be applied to the American River watershed. This watershed is of critical importance to the Sacramento region as the watershed drains directly into Folsom Dam, just upstream of the confluence with the Sacramento River, making this area highly susceptible to catastrophic flooding. Our novel methodology is divided into several steps. First, historic atmospheric and hydrologic conditions have been reconstructed in the American River using the Weather Research and Forecasting Model and the Watershed Environmental Hydrology Model. These data will then be used to identify five critical storms that have the potential to produce PMP and PMF. The selected storms will then be processed through a novel technique to estimate a potential new PMP and PMF under a changing climate. Results will then be compared to historical conditions to



assess how reservoir operations will be affected by the newly developed PMP and PMF estimations. Our results will provide new information to decision makers about potential future extreme events in the American River.

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Google Scholar

UC Davis PhD Student Civil & Environmental Engineering Advisors: Levent Kavvas & Alex Forrest

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All proceeds support our annual conference, student scholarships, and other projects that benefit lake managers in our region. CALMS is operated by volunteers and has no paid staff.





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\$18 Tote Bag



\$5 Magnet

ALGAE THE INFLUENCE OF WATER CHEMISTRY ON ALGAL COMMUNITIES

by Byran Fuhrmann, PhD Aquatic Scientist EutroPHIX Division, SePRO Corporation

Cyanobacteria, diatoms, and green algae are the three major groups of algae found in lakes and reservoirs. While cyanobacteria can be nuisance toxin producers, freshwater diatoms and green algae are nontoxic and serve as a nutritious base of the food web. Algae generally obtain nutrients from the water column or sediment and have diverse nutritional requirements. Nitrogen, phosphorus, and silicon are the most important algal nutrients in most lakes and reservoirs.

Nitrogen

Bioavailable nitrogen generally comprises of ammonium and nitrate. In the summertime, deep, eutrophic lakes

display ammonium-rich often bottom water and nitrate-rich surface Shallow eutrophic lakes water. typically contain nitrate in the water column and ammonium in sediment porewater. Diatoms generally prefer while cyanobacteria and nitrate, green algae prefer ammonium. Cyanobacteria hold competitive advantages over green algae in eutrophic lakes because they can dive to access their preferred nitrogen source in the bottom-water of deep lakes or the porewater of shallow lake sediments. Natural nitrogen limitation is common in shallow eutrophic lakes due to sediment denitrification and a

high sediment surface-area to water volume ratio. In nitrogen limited conditions, some cyanobacteria can fix atmospheric nitrogen, allowing them to become the dominant algal group.

"Phosphorus management stands out as the most feasible method to limit algal abundance and deter cyanobacteria growth."

Phosphorus

Phosphorus tends to be the primary limiting nutrient in lakes and reservoirs. Green algae and diatoms usually require dissolved phosphate, while many



Figure 1. Blooms of toxin producing cyanobacteria often look like floating paint. Photo by <u>Christian Fisher</u>.



Figure 2. Diatoms are unique in their silicon-based cell walls that lead to many intricate structures. Photomicrograph by Randolph Femmer, USGS.

cyanobacteria can secrete enzymes which breakdown organic phosphorus into phosphate. These enzymes can also be used to cause other algae to release phosphate so it can be stolen by the opportunistic cyanobacteria. Cyanobacteria can polymerize phosphate into polyphosphates. This allows them to horde phosphorus when it is abundant to prepare for periods of limitation. Cyanobacteria also have unique abilities to access metal-bound phosphorus in shallow sediments. Iron-bound phosphorus can be obtained through the production of siderophores that chelate iron and release phosphate. Aluminumbound phosphorus can be accessed by benthic cyanobacteria which elevate the sediment pH to release phosphate. Unlike nitrogen, algae cannot obtain phosphorus from the atmosphere. Managing phosphorus has been shown to be effective in reducing the overall abundance of algae as well as shifting communities towards a higher proportion of beneficial green algae and diatoms.

Silicon

Diatoms hold a unique competitive advantage through their utilization of dissolved silicon (silica) to create cell walls. This process requires less energy than building cell walls from carbon obtained through photosynthesis and provides diatoms with a competitive advantage. This also allows them to produce more lipids which makes them very nutritious for planktivorous fish. Due to their advantageous use of silica, diatoms are often the dominant algae in the spring when silica is available. However, high concentrations of anthropogenic nutrients lead to large diatom blooms and the rapid uptake of silica. These diatom blooms are short lived and crash within a few weeks, resulting in the burial of silica contained within their cell walls. This early season process limits growth of diatoms, providing an advantage for green algae and cyanobacteria during the summer and fall.

Summary

Algal community assemblages are ultimately controlled by the water chemistry of lakes and reservoirs. Nitrogen management is very difficult due to the ability of some cyanobacteria to fix atmospheric nitrogen. Phosphorus management stands out as the most feasible method to limit algal abundance and deter cyanobacteria growth. Phosphorus management can also preserve silica within the water column and allow for beneficial diatoms to make up a larger portion of the algal community during the summer and fall.



WATER QUALITY DATA The California integrated report and 303(d) listing process

by Keara Tuso State Water Resources Control Board



What is the California Integrated Report?

Section 303(d) of the Clean Water Act ("CWA") requires states to develop a list of waters not meeting water quality standards. The list, which is referred to as the 303(d) list of Impaired Waterbodies, is updated based on new water quality data and submitted to the U.S. EPA by April 1 of every even-numbered year. Under CWA Section 305(b), each state is required to report biennially on the water quality conditions of its surface waters (referred to as the "305(b) report").

How are data evaluated?

All readily available data and information received before the end of a data solicitation period are considered in the development of the Integrated Report. Surface water data are downloaded from the California Environmental Data Exchange Network ("CEDEN") and National Water Quality Monitoring Portal for assessment. Data types not compatible with CEDEN may be submitted to the State Water Board as described in the data solicitation notice (see resources below).

Good quality data are then assessed per California's Water Quality Control Policy ("Listing Policy"). If there are enough exceedances of a water quality standard for a pollutant, the waterbody is listed as impaired for that pollutant and placed on the 303(d) list. Depending on the level of impairment, these waterbodies may be subject to a Total Maximum Daily Load ("TMDL").

"The Water Board is currently soliciting surface water quality data and information for the 2026 California Integrated Report"

How can we support data collection efforts?

The Water Board is currently soliciting surface water quality data and information for the 2026 California Integrated Report. Any person or entity may submit data and information, including private and nonprofit groups.

The Water Board focuses on three regions of the state in every two-year cycle. The listing cycle for the 2026 Integrated Report focuses on surface waterbodies such as rivers, streams, lakes, reservoirs, estuaries,

Steps	Approx. Months
Data Solicitation	6
Data Organization, Quality Review & Mapping	9
Data Analysis	13
Regional Board Public Process*	10
State Board Public Process*	10
USEPA Review & Approval	1

Overview of the process and approximate schedule used in developing the Integrated Report. A cycle typically takes three to four years to complete. From: Integrated Report Cycles.

lagoons, bays, and ocean waters in the regions of North Coast, Lahontan, and Colorado River Basin Regional Water Boards, as well as the San Joaquin River sub-area of the Central Valley Regional Water Board. Data for regions not mentioned will be also accepted but may not be assessed in the 2026 cycle.

Data submissions must be received no later than 12:00 p.m. noon on October 21, 2022, for the 2026 Integrated Report.

Please direct questions to Keara Tuso (Keara.Tuso@waterboards.ca.gov)



Resources

2026 California Integrated Report Data Solicitation Notice California Environmental Data Exchange Network ("CEDEN") California's Water Quality Control Policy ("Listing Policy") National Water Quality Monitoring Portal

<u>Regional Water Boards Map</u>

Surface Water Quality Assessment website

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FORECASTING WITH WATER QUALITY MODELS: FUTURE PROJECTIONS FOR WATER **TEMPERATURE AT HOOVER DAM**

by Deena Hannoun, PhD

Southern Nevada Water Authority

The Lower Colorado River Basin supplies water to more than 25 million users in Nevada, Arizona, California, and Mexico. Lake Mead, which is located along the Nevada-Arizona border, is a crucial link in the chain of reservoirs along the Lower Basin. The region is experiencing a significant drought since the year 2000, leading to a 173 feet reduction in elevation and a 72 percent decline in reservoir volume (water above Hoover Dam's release capabilities).

Despite this extended drought, water quality in Lake Mead has remained high, and in some cases, significantly improved due to active management efforts. However, as the drought is projected to continue, water quality in Lake Mead and, consequently, what is released downstream, may change.

To forecast future water quality in Lake Mead, three-dimensional hydrodynamic and water quality models are analyzed in conjunction with two-year flow projections generated by the United States Bureau of Reclamation (Reclamation). These projections can aid water managers in responding to future scenarios before they occur.



Figure 1. Lake Mead at Hoover Dam in May 2021. From CNN.

Water quality released downstream through Hoover Dam is projected as part of the modelling framework, which consists of three flow scenarios—the minimum, most probable, and maximum scenarios-provided by Reclamation and updated monthly as part of Reclamation's 24-Month Study (24MS). Historic Colorado River inflow into Mead and historic releases

"... as the drought is projected to continue, water quality in Lake Mead and, consequently, what is released downstream, may change."

from Hoover Dam are replaced with 24MS water quantity projections. Current data show the minimum scenario produces the largest decline in Lake Mead's elevation-approximately 50 feet over the two-year simulation period. The most probable scenario projects 25 feet of drawdown, and the maximum projects a 10foot increase above current lake levels. These projections are updated monthly by Reclamation, and the threedimensional model is updated accordingly.

Data from broad, multi-agency lake sampling efforts are then utilized as boundary conditions for the remaining model inputs. The model is calibrated to field data using nonlinear least squares.

Seasonal median water temperatures at the Hoover Dam for the three projected flow scenarios are compared to measured data (Table 1). Model results assume that water is only released through Hoover Dam's lower outlet due to low lake levels; however, both the upper and lower outlets were used until May of 2022 and are reflected in the historic data set. Model results show

Table 1. Three projected flow scenarios compared to measured data.

Season	Most Probable (projected; 2023)	Minimum (projected; 2023)	Maximum (projected; 2023)	Historic (monthly data; 2021)
Winter (DJF)	12°C	11°C	13°C	15°C
Spring (MAM)	12°C	13°C	12°C	14°C
Summer (JJA)	16°C	20°C	15°C	18°C
Autumn (SON)	21°C	22°C	18°C	18°C

that the exclusive use of the lower outlet draws water from deeper in the thermocline resulting in water releases being cooler with more stable water quality during the winter, spring, and summer (excepting summer minimum scenario); however, data analysis indicates that autumn water temperatures are projected to increase versus historic trends.

Uncertainty in these model results comes from a number of sources, including measurement error, error from both the model and optimizer, plus the use of historic data to drive the model when accurate future projections are not available. These model results are used for planning purposes to study general trends in water quality across broad ranges of scenarios.

Through ongoing water quality sampling and modeling, Colorado River water managers are able to make more informed decisions to protect and the enhance the quality of water they deliver to their customers.

Further Reading

Hannoun, D., T. Tietjen, and K. Brooks. 2021. "The potential effects of climate change and drawdown on a newly constructed drinking water intake: study case in Las Vegas, NV." Water Utility Journal. 1-13.

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CALMS Annual Business Meeting Minutes

October 5, 2021 (Virtual)

Attendees

Deena Hannoun, Alex Forrest, Byran Fuhrmann, Elisabeth O'Keefe, Kelly Lorenz, Marc Beutel, Stephen McCord, Mark Seelos, Priya Ganguli, Matt Williams, Mark Van Austin, Hal MacLean

4:00 PM CALMS Business Meeting begins.

Agenda

Agenda submitted and approved.

Minutes

The 2020 Minutes were approved (minutes were provided in the 2021 Newsletter).

Treasurer's Report

The 2021 conference had more than 192 registrants (free of charge, but many registration donations!). By emphasizing newsletter ads pay for student scholarships, CALMS received funds for 11 ads, including 2 full scholarship sponsors. There were 5 additional conference sponsors including a third scholarship (see accounting below)

Conference Recap

1. Continue with checklists for moderators & tech support (can be used for webinars as well).

2. Mark will continue to update YouTube channel and wrap up email

3. Send out links (YouTube channel, CALMS store, email list, announce bingo winners)

4. YouTube channel subscription game for next year **Scholarships**

Four scholarships in 2021 at \$1250 each; only 4 applicants. a. Determine number and dollar amount for next year

b. Top named scholarship, max amount

c. How to enhance applicant pool? GLEON listserv (only AZ, CA, NV, HI), ASLO, AGU listserv, advertise during conference, reach out to departments directly, broad level California state universities, AWWA,. University clubs

d. Survey grad students (academic CALMS officers)

e. Will see applicants and determine sponsorship funds before funding student scholarships

f. How much money to put in announcement? \$1250+ will

work for now

an rear internet potential

g. Need to start recruiting named sponsors earlier (\$1500 top tier sponsorship)

STAND FRANKLER AND

h. Start with 4 scholarships Website

Matt Williams in charge of website and store.

Webinars

Three webinars in 2021 (quarterly) Looking for 2022 topics Conference kickoff webinar

Newsletter

Moved up schedule and adjusted. Discussion to bring the newsletter together sooner. Formalize newsletter committee-Priya, Byran, Deena. Stephen and Hal to help with editing again. Goal release date: end of June Student money goes out AFTER they have sent appropriate newsletter materials

NALMS

Proposal submitted to host in 2023 was very well received. Waiting on NALMS to sort out this year being moved online. If accepted, we need to continue to work to bring in local attendance and sponsorship

Did anyone ask for reimbursement on CLM or CLP licenses? - No. We will axe this reimbursement. Need to announce! Stephen can lead this after program gets revamped. Add list of CLMs to website

Other Business

Allow speakers to pick an item from the CALMS store? - Yes. Mark will notify speakers.

Incoming President Mark Seelos to coordinate conference calls for next year using Alex's license.

2022 conference will hopefully be in person! Rotation would go to Northern California

Elections

Byran Fuhrmann was suggested as President Elect. Motion: Byran Fuhrmann will be CALMS President Elect for 2022. Passed unanimously. Motion: Stephen McCord will be new CALMS' Northern

Director. Passed unanimously.

Group motions to speak to Elisabet Perez to be new CALMS' Southern Director. Joe Sullivan (Treasurer) and Hal MacLean (Secretary) have agreed to continue in their positions. 2022 Officers President: Mark Seelos President Elect: Byran Fuhrmann Newsletter Director: Priya Ganguli Administrative Director: Matt Williams Southern Directors: Kelly Lorenz and Elisabet Perez Northern Directors: Elisabeth O'Keefe and Stephen McCord Treasurer: Joe Sullivan Secretary: Hal MacLean **Action Items** 1. Lead webinars: Mark, Stephen, Elisabeth a. Aim for 3-4 webinars in 2022 b.. Consider adding conference kickoff webinar in addition to guarterly webinars c. Webinar sponsors-\$250/event d. Use moderator and tech support checklists from 2021 conference as template 2. Schedule next conference call: Mark will send out Doodle poll e. Consider combined November/December call due to holidays, less going on at that time 3. Lead conference calls: Mark 4. Lead communications: Kelly, Byran & future south director a. Conference wrap up email. Send out links: YouTube channel, CALMS store, email list, announce bingo winners 5. Cancel zoom subscription: Matt 6. Prepare newsletter: Priya (director), Byran, Deena a. Put together newsletter schedule before October/next conference call: Priya, Byran, Deena b. June 30 newsletter deadline will require help I. Student scholarship content will need to be sent earlier II. Funding for student scholarships will be requested earlier 7. Set up 2022 conference: conference committee. October,

28



Northern Cal

8. Update group with NALMS/CALMS 2023 developments: Deena

- a. Meeting with NALMS (Todd, Sara) on 10/8
- 9. Follow up to Treasurer's Report: Joe
- a. Add webinar sponsors to Treasurer's report (3x \$250)
- b. Coordinate store revenue with Matt/Joe
- i. Need to figure out PayPal setup when there is more money
- c. Byran's reimbursement for InDesign
- d. Gift cards for sponsor bingo (\$200)
- e. Add speaker gifts (not yet ordered/sent)
- f. Add photo contest gifts (already ordered/sent)
- 10. Email speakers to see what gifts they would like: Mark.
- Coordinate with Matt to send out gifts
- 11. Continue to update YouTube channel: Mark

12. Figure out bingo winners: Deena. Coordinate with Matt to get gift cards sent out and winners posted to website.

13. Increase applicant pool for student scholarships: Marc, support from Priya & Stephen

a. Advertise scholarships as \$1250; may increase amount later (depending on funding/additional travel funds)

b. Will send students initial \$1000 only after correct newsletter content is successfully sent to Newsletter Committee. 14. Sponsorships: Hal

a. Begin search for student scholarship sponsorships earlier. Ask for \$1500. (maybe we discuss a time frame on next call) b. Create tiered sponsorships, \$1500 student scholarship sponsorship is the highest

15. Continue to update website and store: Matt

16. Facilitate CALMS encouraging members to apply for CLM/ CLP after NALMS revamp is in place: Stephen

a. Decided not to continue to offer reimbursement for CLM/ CLP application fee

17.Talk to Elisabet about Southern Director position: Mark

Meeting adjourned at 5:30 PM

CALMS 2021 ACCOUNTING

		Statement Balance 8/1/21
Total Registrants: 181	Shares	\$11,739.00
Total Sponsors: 12	Checking	\$13,597.00
	CD	\$25.32
	Total	\$25,361.32

DATE	то	Affiliate	FOR	EXPENSES	INCOME	
1/3/2020	NALMS		Membership renewal	\$330.00		
5/18/2021	Sergio Valbuena		Student Scholarship	\$1,000.00	5 3	owe \$250
5/18/2021	Shelby Defeo		Student Scholarship	\$1,000.00		owe \$250
5/18/2021	Jeffery Belding		Student Scholarship	\$1,000.00		owe \$250
5/18/2021	Kenneth Larrieu		Student Scholarship	\$1,000.00	2	owe \$250
8/16/2021	Nonprofits Insurance Alliance		Insurance	\$650.00		
10/5/2021	CALMS		Donations		\$845.00	
10/5/2021	CALMS	Clean Lakes	Sponsorship		\$1,250	
10/5/2021	CALMS	Aquatechnex	Sponsorship		\$1,250	
10/5/2021	CALMS	McCord Environmental, Inc.	Sponsorship		\$150	
10/5/2021	CALMS	YSI/Xyelm	Sponsorship		\$250	
10/5/2021	CALMS	Sub Sea Systems, Inc	Sponsorship		\$250	
10/5/2021	CALMS	Eureka Water Probes	Sponsorship		\$150	
10/5/2021	CALMS	Floating Islands West	Sponsorship		\$250	
10/5/2021	CALMS	Floating Islands West	Sponsorship		\$250	
10/5/2021	CALMS	in-situ	Sponsorship		\$150	
10/5/2021	CALMS	ixom	Sponsorship		\$0	Not yet received
10/5/2021	CALMS	WQ solutions	Sponsorship		\$150	
10/5/2021	CALMS	Valley Water	Sponsorship		\$1,000.00	

TOTAL Expense	\$4,980.00	
TOTAL Income		\$5,945.00







Crossword Puzzle Answer Key



Water Quality Solutions, Inc.



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2022 CALMS OFFICERS

WHAT WE DO

PRESIDENT Mark Seelos Santa Clara Valley Water District

OUR EVENTS

ADMINISTRATIVE DIRECTOR Matt Williams Metropolitan Water District of SoCal

SECRETARY Hal MacLean East Bay Regional Park District

NORTHERN DIRECTORS

Elisabeth O'Keefe Santa Clara Valley Water District

Stephen McCord McCord Environmental, Inc.

LEADERSHIP SUPPORT

Eli Kersh, NALMS Region 9 Director Marc Beutel, Student Scholarship Coordinator Priya Ganguli, Newsletter Director

PRESIDENT-ELECT

OUR PROJECTS

Byran Fuhrmann SePRO Corporation

TREASURER

Joe Sullivan East Bay Regional Park District <u>GET INVOLVED</u>

SOUTHERN DIRECTORS

Kelly Lorenz Metropolitan Water District of SoCal

Elisabet Perez Coronel Southern Nevada Water Authority

> Deena Hannoun, Advisor Imad Hannoun, Advisor Alex Forrest, Advisor Jeff Pasek, Advisor

Thanks to our CALMS Committee Members!

Mark Seelos (Chair) **Byran Fuhrmann** Priya Ganguli Deena Hannoun Eli Kersh **Kelly Lorenz**

NEWSLETTER COMMITTEE

PROJECTS & WEBINARS COMMITTEE

Stephen McCord (Chair) **Byran Fuhrmann Elisabet Perez Coronel Mark Seelos**

OUTREACH COMMITTEE

Kelly Lorenz (Chair) Elisabeth O'Keefe **Matt Williams**

CONFERENCE COMMITTEE

Hal MacLean **Stephen McCord** Elisabeth O'Keefe Joe Sullivan **Matt Williams**

STUDENT SCHOLARSHIP COMMITTEE

Marc Beutel (Chair) **Alex Forrest** Priya Ganguli **Stephen McCord**

Priya Ganguli (Chair) **Byran Fuhrmann** Deena Hannoun **Hal MacLean**

CALMS 37TH ANNUAL CONFERENCE

Thursday, October 13, 2022 Conference Agenda

Room	Time	Title	Presenter
	8:00	Meet and Greet/ Breakfast	
Grand Lake	9:00	Welcome/State of the Lakes	Mark Seelos
	9:15	Keynote Address: Managing Reservoirs Under Future Climate Scenarios	Deena Hannoun
Grand Lake	9:50	Sponsor Presentations	Eli Kersh
		NETWORKING BREAK (10:10 - 10:35)	
	10:35	Predicting Future Maximum Precipitation and Flooding Events in the American River	Emily Snider
	10:45	Development of a Low-Cost In-Situ Cyanobacteria Sensor	Kanarat Pinkanjananavee
	10:55	Understanding Patterns of Carbon Dioxide Release from Uvas Reservoir	Julliana Porraz
Grand Lake	11:05	Partitioning Methane Flux Emissions from Reservoirs in Mediterranean Climates	Corrin Clemons
	11:15	What lies beneath: The unrealized Methane Potential of Mediterranean climate reservoirs	Ruth Thirkill
	11:35	Assessing internal loading and water quality before and after oxygenation in Hodges Reservoir, San Diego	Naivy Rodal Morales
	11:55	Announcements: Lunch and Afternoon Sessions	Stephen McCord
		LUNCH (12:00 - 1:00)	
		Concurrent Afternoon Sessions	
	1:00	Sites Reservoir Project	John Spranza
	1:30	Lake Tahoe's 3d Upwelling	Fabian Bombardelli & Sergio Valbuena
	2:00	Outflow Management for Fisheries Enhancement	Jason Nishijima
Grand Lake	2:30	BREAK	
	3:00	Tracer Studies and Hydrodynamic Modeling Guidance for Lake Managers	David E. James
	3:30	Development and Tracer Study Validation of a 3D Model of Miramar Reservoir for Indirect Potable Reuse	Kareem Hannoun
	4:00	Long-term water quality assessment identifies evidence of climate change impacts in a Southern California Reservoir	Hayden Franciscus
	1:00	Microplastics Regulation	Scott Coffin
	1:30	State Parks Division of Boating & Waterways QZ Grant Program	Timothy Giles
	2:00	Managing Cyanobacteria Blooms	Terry McNabb
Temescal	2:30	BREAK	
	3:00	Improving Water Quality with Adaptive Management Strategies	RyanVan Goethem
	3:30	The Holistic Restoration of an Urban Lake, Presidio of San Francisco	Jonathan Young

Wishing you and yours a happy and healthy year!



och Lomond Reservoir, Santa Cruz, CA Credit: Jeremy Mathews

CALMS 37TH ANNUAL CONFERENCE

City of Oakland



OCTOBER 12, 2022

7PM: PRE-CONFERENCE HAPPY HOUR

SANTE ADAIRIUS RUSTIC ALES 460 8TH ST., OAKLAND, CA 94607

OCTOBER 13, 2022

9 AM - 4:30 PM: CONFERENCE

CAL STATE EAST BAY OAKLAND CENTER 1000 BROADWAY, OAKLAND, CA 94607

4:30 - 5:30 PM: BUSINESS MEETING

OPEN TO ALL! BOARD OPPORTUNITIES AVAILABLE!

CAL STATE EAST BAY OAKLAND CENTER 1000 BROADWAY, OAKLAND, CA 94607

6 PM - 9 PM: RECEPTION LAKE CHALET SEAFOOD BAR AND GRILL 1520 LAKESIDE DR., OAKLAND, CA 94612

OCTOBER 14, 202 8 AM - NOON: FIELD TOUR TEMESCAL RESERVOIR

TRANSPORTATION TO/FROM PROVIDED