

Blue Ribbon Committee for the Rehabilitation of Clear Lake

2020 Report to the Governor and California State Legislature

Annotated Draft Outline for Committee Revision

[]INSERT DATE]

Section 1: Background

Clear Lake is one of the top two contributors to the local Lake County economy, according to the 2016 Lake County Comprehensive Economic Development Strategy, which cites the lake as “the cornerstone of the local visitor and recreation markets,” mainly through boating and bass fishing tourism.¹ It is essential to the traditional cultural resources and economies of the seven federally recognized tribes of the area; the condition of the lake affects the safety of traditional ceremonies, as well as fishing and consumption of fish in accordance with tribal customs.

Clear Lake is the oldest species-rich, warm water, natural lake in North America. It supports the surrounding ecosystems of native plants and animals, as well as species introduced by the Department of Fish and Wildlife. Clear Lake and the surrounding environment are also a home to endangered and rare animal species. However, the lake also experiences environmental challenges such as harmful algal blooms and mercury contamination from legacy mining issues.

In light of the environmental challenges facing Clear Lake and Lake County, Assembly Bill (AB) 707 (Aguiar-Curry, 2017) was passed by the California Legislature (Legislature) and signed by Governor Jerry Brown to create a Blue Ribbon Committee (Committee) to develop strategies to clean up Clear Lake and revitalize local economies dependent on the health of the Lake. AB 707 places the Committee under the management of the California Natural Resources Agency (Resources), with the Resource Secretary or designee serving as Committee Chair. Additionally, the Legislature appropriated \$5 million in Proposition 68 funding for Clear Lake-specific capital improvement projects to improve conditions in the lake. The Committee will play a significant role in determining appropriate projects for funding.

This report represents the second annual report to Governor Gavin Newsom and appropriate committees of the California State Legislature as required by AB 707. AB 707 specifically requires annual reports to identify barriers to improved water quality in Clear Lake, the contributing factors causing poor water quality, and the threats to wildlife. The report must include recommendations on solutions to these issues,

1

<https://www.lakecountyca.gov/Assets/Departments/Economic+Development/Docs/2016+CEDS+Report.pdf?method=1>

estimates of cost, and a plan for involving the local, state, and federal governments in funding for and implementation of lake restoration activities.

The Committee is a multi-year process; this report outlines implementation steps for recommendations developed in 2019, including specific funding recommendations for the next budget cycle. These implementation steps are designed to address the challenges noted above, beginning with a robust data collection effort to ensure future environmental and socioeconomic recommendations are based on the most up-to-date analysis possible.

Section 2: COVID-19 Response and Modifications to 2019 Recommendation Implementation

On March 19, 2020, Governor Gavin Newsom issued a statewide shelter-in-place order to combat the COVID-19 pandemic. The impacts of the pandemic are far reaching and affect nearly every sector of government and the economy. The economic downturn associated with the pandemic drastically reduced available budget for nearly all projects and effort requiring general fund appropriations, including Committee activities.

In the spring of 2020, the Committee requested \$5.5 million in general fund appropriations to implement its 2019 recommendations. Due to budget shortfalls, the State of California was unable to provide funding. As a result, this report advocates for a carryover of funding for these recommendations as part of the FY 21/22 budget cycle, in addition to providing specific implementation measures for each recommendation. Although the Committee continues to investigate alternative sources of funding, its expectation is that implementation money may not be available until the FY 21/22 budget is approved in June of 2021.

A breakdown of funding requests is available in **Appendix A**; a discussion of alternative funding sources is provided in **Section 6**.

Section 3: Committee Process and Progress to Date

Committee Deliberations

This section provides a brief background on the Committee, its subcommittees, and summarizes their deliberations in 2020. Resources launched the Committee effort in June 2018 by requesting applications from local County and tribal representatives in accordance with AB 707, including:

- A representative from the University of California (appointed by the Chancellor of the University)
- One member of the Board of Supervisors from Lake County or their designee
- Representatives from tribes impacted by Clear Lake, appointed by their respective tribal councils

- The Resources Secretary or their designee
- A represented of the Central Valley Regional Water Quality Control Board (Regional Water Board), appointed by its board
- An expert from each of the follow areas, appointed by the Lake County Board of Supervisors:
 - Local economic development
 - Agriculture
 - Environment
 - A public water supplier drawing its water supply from Clear Lake

A full list of the current membership of the Committee is available in Appendix E.

Committee Process to Date

The Committee met a total of four times in 2020. The table below includes the meeting schedule and a brief summary statement of topics discussed at each session. Complete summaries, as well as video and/or audio recording of each meeting are available online at www.resources.ca.gov/clear-lake.

Meeting Date	Summary
March 11, 2020	
June 18, 2020	
September 23, 2020	
December 9, 2020	

Table 1: 2018/19 Committee Schedule and Outcomes

Technical Subcommittee Process to Date

The Technical Subcommittee is the primary venue for detailed discussions of lake science and the environmental factors impacting water quality in Clear Lake. Members include local stakeholders with a deep knowledge of lake conditions, tribal water quality experts, researchers from UC Davis, and state and federal agency representatives. A complete roster of regular Technical Subcommittee attendees is included in Appendix E.

The Subcommittee met a total of (ENTER FINAL NUMBER OF MEETINGS) in 2020. The table below includes a meeting schedule and brief summary of topics discussed during each session. Complete summaries and audio recordings of each meeting are available online at www.resources.ca.gov/clear-lake.

Meeting Date	Summary

Socioeconomic Subcommittee Process to Date

In the summer of 2020, the Committee formally launched its Socioeconomic Subcommittee. Similar to the Technical Subcommittee, this group is comprised of local stakeholders with a deep understanding of socioeconomic opportunities and challenges facing Clear Lake communities. It’s primary purpose is twofold: developing specific measures for Committee consideration to alleviate socioeconomic challenges, and ensuring recommendations from other subcommittees do not adversely affect the Clear Lake economy whenever possible. Socioeconomic Subcommittee attendees is included in Appendix E.

The Subcommittee met a total of (ENTER FINAL NUMBER OF MEETINGS) in 2020. The table below includes a meeting schedule and brief summary of topics discussed during each session. Complete summaries and audio recordings of each meeting are available online at www.resources.ca.gov/clear-lake.

Meeting Date	Summary

Committee Support and Parallel Research Efforts

Resources contracted with the Sacramento State University College of Continuing Education Consensus and Collaboration Program (CCP) in August of 2018 to provide neutral facilitation and process management services for the Committee. CCP works closely with Resources and Committee membership to design agendas, facilitate all Committee meetings, carry out routine negotiations between members over recommendations, and ensure all outreach meets the requirements of the Bagley Keene Open Meetings Act.

The UC Davis Tahoe Environmental Research Center (TERC) was selected to lead a research effort on the health of the lake, factors contributing to environmental challenges, and develop a 3-D hydrodynamic model of Clear Lake. UC Davis's Center for Regional Change (CRC) was selected to lead a parallel socioeconomic research effort. These efforts run in parallel to, but are separate from, the Committee effort. Research from both entities will inform the Committee's work in the future. Additional information on both research projects is described below.

An organization chart showing the interrelation between these parallel but separate efforts and the Committee is provided in **Appendix B**. As the TERC and CRC research efforts are funded through December 31, 2020, it is expected their research outcomes will provide foundational information for future Committee projects and actions.

TERC Information

Insert TERC executive summary. A summary of TERC's research and outcomes to date is provided in **Appendix C**.

CRC Information

Insert CRC executive summary. A summary of CRC's progress to date and next steps is included in **Appendix D**.

Section 4: Barriers to Improving Water Quality and Threats to Wildlife

For 2019, the Committee and Technical Subcommittee opted to focus on the causes of HABs from cyanobacteria, as well as elevated methyl mercury levels as prominent water quality issues in Clear Lake. This section lays out key water quality issues, barriers to improving the physical condition of Clear Lake, and threats to wildlife caused by these issues and identified by Committee, Technical Subcommittee, and the parallel efforts at UC Davis.

Initial recommendations to further understand these challenges are presented in Section 4 below, and are expected to result in a suite of management activities after 2020.

Water Quality Issues: Harmful Algal Blooms

HABs resulting in detectable levels of cyanotoxins in Clear Lake have been directly linked to documented pet and livestock deaths, and human exposure leads to a variety of health problems including gastrointestinal issues, skin issues, and neurological impacts. The most common pathway for human and pet exposure is through direct contact with untreated lake water (i.e., swimming in or drinking untreated water). However, cyanotoxins generally and microcystins more specifically, are on the contaminant candidate list (CCL) as a currently unregulated contaminant of concern for public water

systems by the US Environmental Protection Agency (US EPA).² California has developed recreational trigger levels for human and animal health for three cyanotoxins including microcystins. US EPA has developed recreational water quality criteria, swimming advisories, and drinking water health advisories for cyanotoxins.³ Additionally, HABs impact lake aesthetics and produce strong odors which may dissuade recreation and other uses.

Current scientific understanding of HABs shows blooms are caused by several key factors such as nutrient availability (particularly phosphorus and nitrogen), duration of sunlight, water temperature, and stability of the water column. Nutrient availability appears to be a primary driver of HABs in Clear Lake, which occur most often in mid/late summer but may be present at other times of the year. In response to nutrient issues, the Regional Water Board issued a Total Maximum Daily Load (TMDL) restriction to address the issue in 2006.⁴ This TMDL is currently the primary regulatory mechanism to address nutrient issues throughout the Clear Lake basin, and requires responsible parties to meet specified point and nonpoint load allocations to limit the loads of phosphorus entering the lake. The Board does not specify the manner of compliance with the TMDL. It is up to the responsible parties to determine how they will meet their load allocations and demonstrate compliance.

Water Quality Issues: Mercury and Methylmercury

Mercury is naturally present throughout California and may leech into Clear Lake from a variety of sources. However, the former Sulphur Bank Mercury Mine site, located near the City of Clearlake and adjacent to the Elem Indian Colony Reservation, is a known, significant source of human-caused infiltration. Sulphur Bank is an active US EPA Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site, commonly known as "Superfund."⁵

High mercury levels are due to the watershed inputs, the existing sediment load, and ongoing input from the Sulphur Bank Mine Superfund site. Understanding the mercury cycle in the lake is currently an active area of research at Clear Lake by the US Geological Survey (USGS). There are a range of engineering options for controlling mercury release to the water and the food web.

Once mercury becomes biologically available through a process known as methylation, it collects in fish tissue, may be ingested by humans and animals alike, and increases in concentration as it moves up the food chain. In the vast majority of exposure cases, methylmercury is ingested by eating contaminated fish and shellfish. Methylmercury poses a range of significant neurological health impacts, particularly for sensitive groups including young and elderly individuals, and in pregnant women.⁶

² https://www.epa.gov/sites/production/files/2014-08/documents/cyanobacteria_factsheet.pdf
<https://www.epa.gov/cyanoHABS/epa-drinking-water-health-advisories-cyanotoxins>
<https://www.epa.gov/wqc/recommended-human-health-recreational-ambient-water-quality-criteria-or-swimming-advisories>

³ https://mywaterquality.ca.gov/habs/resources/habs_response.html#trigger_levels

⁴

https://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/clear_lake_nutrients/2018_0627_tech_memo_final.pdf

⁵ <https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.cleanup&id=0902228>

⁶ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3514465/>

On December 6, 2002, the Regional Water Board adopted a TMDL for the control of mercury in Clear Lake. The Clear Lake Mercury TMDL outlines a process to reduce mercury impacts on the lake through remediation and erosion control activities on the Sulphur Bank mine site, the development of monitoring activities, coordination with the Tribes in the Clear Lake basin, public outreach and education, and a review of progress toward meeting fish tissue objectives for Clear Lake every five years. Load allocations for the Clear Lake Mercury TMDL apply to tributaries and surface water runoff and to the Sulphur Bank Mine Superfund site.

In the context of these overarching water quality issues, the Committee, Technical Subcommittee, and TERC identified specific barriers to water quality improvement and threats to wildlife, including institutional challenges, lack of quantitative data, and physical/environmental barriers. These items are discussed in detail below.

Water Quality Issue: Native Vegetation Dominance vs. Turbid Phytoplankton-Dominated State

Native aquatic vegetation (such as tules, cattails, and other so-called “macrophytes”) stabilize clear-water conditions by reducing resuspension, increasing sedimentation, providing habitat for fish, and suppressing phytoplankton growth (nutrient competition). When the nutrient concentrations in the water are very high, the submerged and emergent native vegetation can be lost and the turbidity of the water increases. As a result, the buffering capacity of the ecosystem to external stressors is reduced. The current state of Clear Lake waters based on the limnological parameters is being assessed by TERC.

Barriers to Water Quality Improvement: Institutional Barriers

Nearly all of Lake County (including all population centers in the County) is designated as a disadvantaged community by the California Department of Water Resources (DWR). Over 20% of the County is at or below the poverty line according to US Census Bureau estimates.⁷ Funding from the County level for lake restoration activities has often been limited, resulting in limited implementation of the TMDL and other, locally led regulatory efforts. Initial suggestions for resolving institutional barriers to water quality improvement include:

- Stronger coordination between Lake County Water Resources Department (WRD), Environmental Health, and Community Development Departments and oversight by the Board of Supervisors and/or County Administrative Officer. Local regulatory programs are in place, but there is not a mechanism to ensure compliance and that follow-up is conducted. One example of this is on-site project monitoring during and after construction projects.
- Increased revenue streams through permitting fees to support the programs directly responsible for regulatory compliance.
- Stable, long-term funding for water quality improvement projects. Three minimal, local sales tax measures were narrowly defeated in recent years. A lack of trust that funding will be utilized correctly and limited understanding of the importance of special sales tax to fund water quality improvements is a major barrier to long-term environmental restoration.

⁷ <https://www.census.gov/quickfacts/lakecountycalifornia>

- Include older septic systems in the Land Agency Management Plan (LAMP) mapping process. This is particularly important for septic systems along the shoreline. Documentation is not currently digitized and easily shared between key departments.

Barriers to Water Quality Improvement: Lack of Quantitative Data

While lists of water quality challenges can be readily compiled, the greatest barrier to improving the water quality issues and other physical challenges facing Clear Lake is the absence of quantitative data on the response of the Lake to specific restoration projects. Acquiring quantitative data requires completing four fundamental tasks:

- 1) Quantifying the processes that contribute to poor water quality, i.e. data collection;
- 2) Accurately predicting the lake response to environmental forces, including quantifying the extent of the current water quality challenges, i.e. model development;
- 3) Quantitatively evaluating the impacts, the costs, and unintended consequences of implementing particular projects and strategies, i.e. scenario development; and,
- 4) Quantitatively evaluating the consequences and costs of “no action” to improve water quality

Barriers to Water Quality Improvement: Physical and Environmental Challenges

Past research, together with the experiences of residents and stakeholders around Clear Lake, have made it possible to identify many of the challenges facing the lake that these four tasks will address. These challenges include:

- *Changes in land use and alteration of the natural shoreline* are a major driver of water quality issues in Clear Lake. Land use changes over many years have virtually eliminated natural wetlands, and modifications to slopes/cover appear to increase nutrient discharge (particularly phosphorus) into Clear Lake. Additionally, native tules have been removed from the shorezone, further reducing natural nutrient filtration.
- *Lake water temperatures* are increasing globally, and Clear Lake is no exception. Aside from the direct effect of higher temperatures on metabolic and reaction rates, the most important consequence of this is expected to be an increase in the duration of periods of thermal stratification. Mixing or turnover events may be less effective and frequent. This trend cannot be prevented by local action as it is happening on a global scale, but all planning needs to explicitly take this into account. Management actions can be designed to account for rising temperatures, and any future projects should take potential climate change impacts into account during design.
- *Episodic low dissolved oxygen (DO)* events in the deep water are known to occur, producing fish kills, release of nutrients through a phenomenon known as “internal loading,” release of heavy metals including mercury to the food web, and the formation of noxious odors. With climate warming, there are likely to be more extended periods of low DO, with a corresponding increase in water quality degradation. There are engineering solutions to addressing low DO, but the

extent of the problem needs to be quantified in order to make these solutions feasible and cost-effective.

- *The relative contribution of nutrient inputs* (both phosphorus and nitrogen) through both external and internal loading likely drives cyanobacteria production but is not well understood. External loading can be increased by agricultural fertilizer addition, grazing, airborne dust, erosion due to poor land management or wildfire, increases in impervious land cover due to population growth, destruction of wetlands, etc. Internal loading is caused by low DO in the lake. Quantifying the sources of nutrients, their seasonal variability, and partitioning the loading rates (both internal and external) are key to selecting the most appropriate solutions to excessive nutrient build up (also known as eutrophication).
- *Increasing frequency, biomass, duration and distribution of both algal blooms and cyanobacterial blooms* drives many of the water quality issues in Clear Lake. Although algal blooms in general are a natural phenomenon in freshwater lakes, the frequency and toxicity of harmful cyanobacteria specifically appear to be increasing in Clear Lake. Cyanobacterial blooms create risks to human and animal health, increase the costs for water treatment, contribute to a negative perception of the region leading to losses in tourism, property values, and business. Factors that may favor the cyanobacterial dominance include:
 - Episodic low DO events in the deep waters, leading to nutrient release and alterations in the food web;
 - Increased nutrient inputs from the watershed; and,
 - Rising water temperatures.

Impacts to Wildlife

The threats to wildlife are intimately linked to the water quality condition of the lake. While some of the threats may be independent of the eutrophic status of the lake, a better understanding of the relations between watershed and lake processes will be essential when addressing these and other threats. Some of the threats include:

- Episodic low dissolved oxygen (DO), potential hydrogen (pH) levels, and ammonia/ammonium ($\text{NH}_3\text{-NH}_4$), which may cause fish kills;
- Extensive periods of “fish habitat compression”, occurring when low DO deep waters and high surface temperatures reduce the fish habitat;
- The dominance of non-native fish, which may modify nutrient cycling, cause habitat loss, and be more dominant in the food chain as compared to native species;
- Loss of native fish species such as tule perch (*Hysterocarpus traskii*) due to herbicide use on aquatic plants;
- Loss of native fish species such as Clear Lake hitch (*Lavinia exilicuada*) due to multiple stressors, including loss of spawning habitat, water diversions, and barriers to passage; and,
- Potential for the introduction of new aquatic invasive species such as Quagga mussels (*Dreissena bugensis*). While Quagga mussels are not currently in the lake, and significant efforts are being taken to prevent their establishment in the lake, the change in a broad suite of factors

tends to increasingly disadvantage native species while at the same time creating niches for species that may previously not have survived in Clear Lake.

Section 5: 2020 Committee Recommendations and Implementation Steps

This section will include a recap of recommendations from the 2019 report, as well the implementation plan and specific information on the SPARROW model, including the proposed monitoring plan and locations identified by the Technical Subcommittee.

As noted in Section 2, funding shortfalls caused by the COVID-19 pandemic limited available funding for the implementation of 2019 Committee recommendations in 2020. **At this time, the Committee recommends full funding based on the table provided in Appendix A as its primary recommendation this year.** Additionally, the funding shortage has impacted other existing critical water monitoring and research programs. This section describes the recommendations below and discusses proposed implementation measures where available.

2019 Recommendations for Funding in 2021

1. Develop a distributed model of the upper watershed
2. Implement a comprehensive basin-wide monitoring strategy
3. Conduct a bathymetric survey of Clear Lake
4. Review the implementation of existing Tribal, local, State, and Federal programs, Best Management Practices (BMPs), and other management requirements in the Clear Lake Basin
5. Assess the public's perceptions, attitudes, and knowledge gaps towards water quality in order to improve education and ultimately human impacts on Clear Lake

2020 Recommendations for Funding in 2021

Due to funding shortages, two critical existing programs will likely be cut in 2021. These items are existing programs currently funded by the Department of Water Resources and the California Department of Fish and Wildlife respectively. Although the total investment in these programs is relatively small compared to the other recommendations, cessation of funding will likely have significant impacts on Lake County's ability to monitor water quality in the lake (in the case of recommendation 6) and fully implement recommendations 1-5 above (in the case of recommendation 7):

6. Long-term Clear Lake limnological sampling
7. Clear Lake in-lake modeling and research by UC Davis

Recommendation Review

Several of the recommendations are interconnected. The first item is informed by items 2 and 3, all of which are expected to inform and integrate with the existing hydrodynamic lake model under development by TERC. The lake model is expected to identify specific internal sources of nutrient and mercury discharge; once the model is complete, a series of physical actions and capital projects can be designed to address specific pollution sources. The watershed model would provide a picture of external loads to Clear Lake, and in tandem with the internal loading information provided by the internal lake model, would create a full picture of nutrient and mercury loading to the lake. The bathymetric survey is an essential component to assure the accuracy of the hydrodynamic lake model.

Recommendations 4 and 5 include activities to address institutional barriers to water quality improvement and expedite planned restoration projects.

Section 6: Proposed 2021 Workplan

Securing funding for the existing set of recommendations is the highest priority for the Committee's work in 2021. As discussed above, the Committee and its associated subcommittees have developed detailed implementation steps to institute all recommendations as soon as funding becomes available. It is expected that upon appropriation of funds, the Committee will work closely with the Resources Agency to develop contracting mechanisms to carry out all work. A suggested schedule of

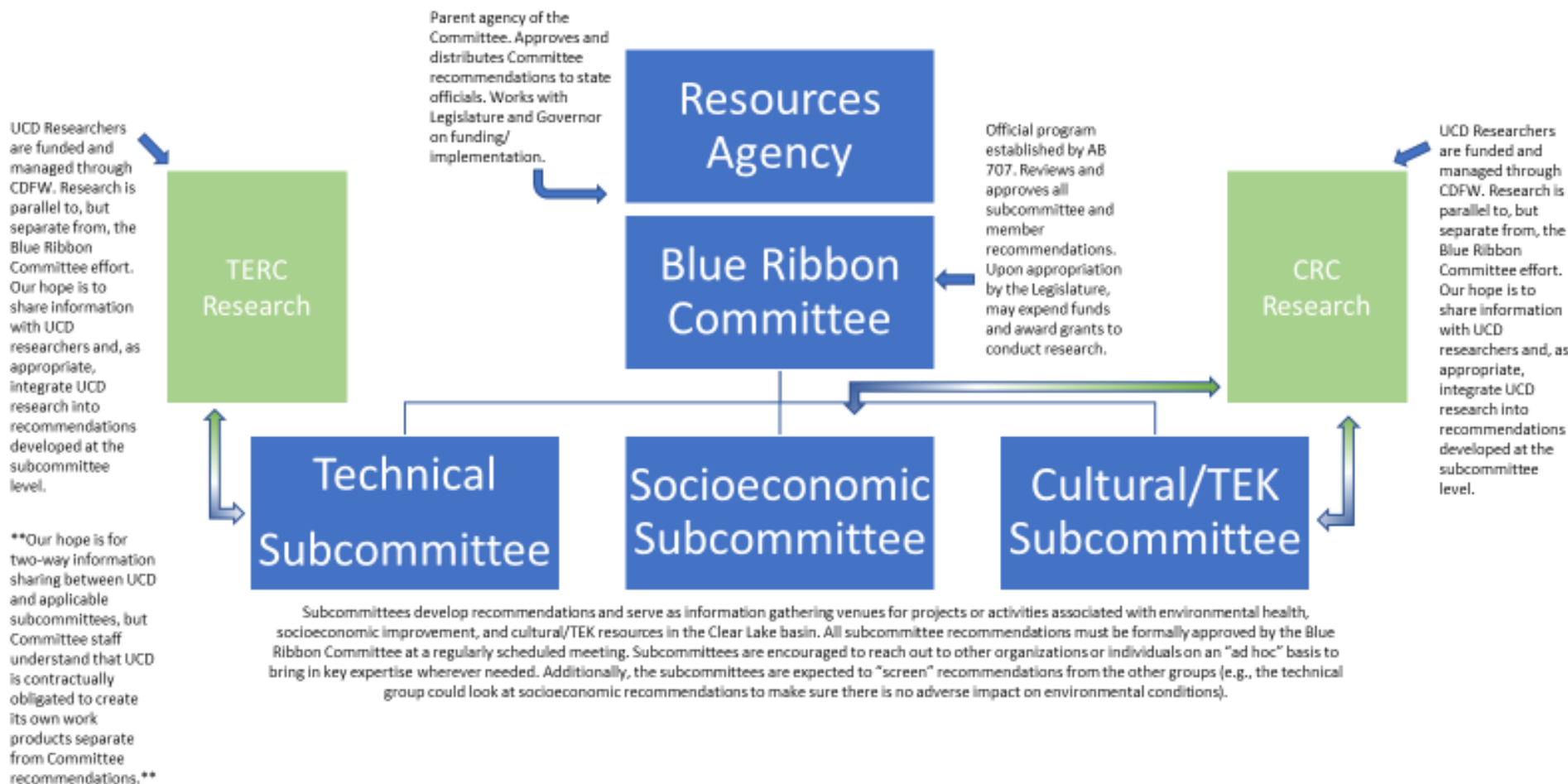
Appendix A: 2021 Funding Request and Associated Recommendations

Currently Proposed								
Requesting Org.	Item	Description	2020 Request	Amount	2021 Request	Amount	2022 Request	Amount
Blue Ribbon Committee	Distributed Watershed Model	Comprehensive watershed model of Clear Lake basin to understand upland/upper watershed sediment and nutrient transport to inform state and local decision making for restoration/remediation activities. Estimate based on USGS proposal; requires discussion.	1 year	\$495,000	1 year	\$ 464,424	1 year	\$ 533,100
Blue Ribbon Committee	Basin-wide Monitoring	Monitoring for model calibration. Includes equipment outlay, O&M, and analysis. Includes nutrients, sediment, and cyanotoxin.	1 year	\$775,000				
Blue Ribbon Committee	Bathymetric Survey	Add on bathymetric survey to refine TERC in-lake model	1 year	\$400,000				
Blue Ribbon Committee	Review existing BMPs	BRC developed to create understanding of BMP effectiveness for existing regulatory programs	1 year	\$60,000				
Blue Ribbon Committee	Public assessment	Public perception survey to better understand residents' attitudes and behaviors impacting lake health.	1 year	\$120,000				
UC Davis Tahoe Environmental Research Center	Research Contract	Research contract with CDFW to develop numerical models for to inform state and local decision making on in-lake processes	3 years	\$1,850,000				

Appendix A: 2021 Funding Request and Associated Recommendations

UC Davis Center for Regional Change	Socioeconomic Analysis	Conduct a socioeconomic analysis to improve community vitality of the Clear Lake region.	3 years	\$600,000				
Blue Ribbon Committee	Database reconciliation and data analysis	Catalogue, reconcile, and analyze existing data sets for hydrologic, cyanotoxin, and other past Clear Lake monitoring data including federal, state, and local data.	1 year	\$200,000				
		Totals:	2020 budget	\$4,500,000	2021 budget	\$ 464,424	2022 budget	\$ 533,100
							Total 3 year request:	\$5,497,525

Appendix B: Committee Organization Chart



Appendix C: UC Davis Tahoe Environmental Research Center Outcomes and Next Steps



DRAFT

Appendix E: Committee and Subcommittees Roster

Name	AB 707 Membership Category	Appointing Entity
Brenna Sullivan	Agriculture	Lake County
Harry Lyons	Environmental	Lake County
Jan Coppinger	Public Water Supply	Lake County
Jennifer LaBay	Regional Water Board	Central Valley Regional Water Quality Control Board
Eddie "EJ" Crandall	Lake County Board of Supervisors	Lake County
Alix Tyler	Tribal Representative	Elem Indian Colony
Linda Rosas-Bill	Tribal Representative	Habematolel Pomo of Upper Lake
Mike Shaver	Tribal Representative	Middletown Rancheria of Pomo Indians
Paul Dodd	UC Davis	UC Davis
Sarah Ryan	Tribal Representative	Big Valley Band of Pomo Indians
Terre Logsdon	Tribal Representative	Scotts Valley Band of Pomo Indians
Wilda Shock	Local Economy	Lake County
Karola Kennedy	Tribal Representative	Koi Nation
Irenia Quitquit	Tribal Representative	Robinson Rancheria