Delta Independent Science Board
DELTA STEWARDSHIP COUNCIL

715 P Street, 15-300
Sacramento, CA 95814

916.445.5511
DELTACOUNCIL.CA.GOV

March 28, 2024

Delta Stewardship Council
Delta Science Program
715 P Street, 15-300
Sacramento, CA 95814

Delivered via email: collaborativescience@deltacouncil.ca.gov

RE: Review of draft Cyanobacterial Harmful Algal Bloom Monitoring Strategy for the Sacramento-San Joaquin Delta

Dear Delta Science Program:

The Delta Independent Science Board (Delta ISB) examined the draft of the Cyanobacterial Harmful Algal Bloom Monitoring Strategy for the Sacramento-San Joaquin Delta. The draft strategy covers many of the important factors motivating the development of a robust strategy for monitoring cyanobacterial harmful algal blooms (CHABs) in the Delta. The draft strategy also includes a good review of many of the environmental drivers impacting the occurrence and severity of CHABs and of current programs that monitor CHABs in the Delta. In addition, the draft strategy provides a valuable overview of the heterogeneity of conditions across the Delta system as they pertain to the incidence and severity of CHABs. The draft strategy also outlines 19 special studies that would help to inform the development of a detailed monitoring plan.

In reviewing the draft strategy, we noted several elements that could strengthen the draft strategy and that we encourage the authors to consider as they prepare the final version of the strategy.

1. The executive summary should better reflect the context and scope for the report. The summary is vague in outlining the reasons for which CHABs were identified as “most problematic in Delta waterways” during the Delta Science

Program workshop on HABs. The protection of public health as a goal in developing the strategy is also not mentioned or explained. Further, the funding context is also unclear in the summary, e.g., the lack of funding is noted in the second paragraph, but in the next paragraph the need for a phased approach to prioritize investment is highlighted.

2. While Chapters 1, 2, and 3 provide a good overview of current monitoring and the state of the science in CHAB dynamics, there is a need to present the problem more explicitly and firmly from the perspective of public health and the risks associated with CHAB toxins as neurotoxins. For example, in section 1.5, the exclusion of public health protection is noted, but the reasons for the delays in developing a plan for public health protection are not explained. In addition, the regulatory framework for monitoring CHABs could be more clearly explained.

3. The draft strategy correctly identifies satellite observations as a valuable potential component of a monitoring strategy. The report only mentions a subset of potential space-borne instruments, however. While the report does discuss data from the Sentinel-3 satellite, it does not acknowledge the potential role of other instruments. For example, NASA's Plankton, Aerosol, Cloud, ocean Ecosystem (PACE) satellite that launched in February 2024 could be instrumental for CHAB monitoring. In addition, the use of NASA's Earth Surface Mineral Dust Source Investigation (EMIT) instrument aboard the international space station for monitoring blooms is an active area of research. There are also potential opportunities for use of private sector data, such as those from Planet Labs, which have been used for monitoring HABs.

4. More broadly, there is an opportunity to think more deeply about what an integrated monitoring approach that includes satellite remote sensing, drone flights, and *in situ* observations might look like. An integration of these monitoring approaches in real-time could be used to support effective management decisions to mitigate severe CHABs in specific vulnerable habitats for example.

5. The draft strategy covers many of the primary drivers of CHABs but does not address interactions between them to a sufficient degree. For example, the relationship between precipitation and nutrient loading has been the focus of a number of recent studies. Another example of an interaction to consider is that of nutrient stoichiometry in controlling the composition of the phytoplankton populations. In this context, the relative amounts of available nitrogen,

phosphorus, and silica may be important. Because diatoms require dissolved silica to bloom, greater silica availability may mitigate the dominance of the phytoplankton by cyanobacteria. These could also be topics for additional "special studies" (Chapter 5).

6. The draft strategy focuses very strongly on the growth rates and abundance of cyanobacteria and much less so on the concentrations of toxins produced by the cyanobacteria. Recent studies have shown that the abundance of cyanobacteria does not consistently track with toxin concentrations and that these two quantities respond to drivers differently. Because toxin concentrations are of critical importance for assessing human and ecosystem health, the monitoring strategy must address them more directly.

7. The draft strategy does not sufficiently examine the role of selective grazing on population dynamics in promoting the dominance by cyanobacteria. Cyanobacteria can become the dominant members of the phytoplankton community because other taxonomic groups of phytoplankton, such as diatoms or chlorophytes that do not produce toxins, are a preferential food source for zooplankton. Thus, the role of selective grazing on phytoplankton taxa that could potentially compete with cyanobacteria for nutrients could contribute to the increase in cyanobacteria, allowing their populations to proliferate. This scenario would correspond to a top-down control on the phytoplankton community composition. At a fundamental level, greater understanding of the competitive benefit to the cyanobacterial population in producing toxins, which is energy intensive, could be useful in informing management actions.

8. The strategy mentions the idea of holding regular training on the use of the microcystis visual index (MVI). We strongly support this idea as the MVI, although qualitative, is the longest-running data record of HABs in the Delta and could be effective as an indicator for high concentrations of cyanotoxins.

9. We recommend that the strategy consider exploring lessons learned from the development of CHAB monitoring strategies in other well-studied systems across the United States, such as the Great Lakes. This could include technological and scientific aspects as well as adaptive management strategies.

10. Overall, the draft strategy is quite general and is not sufficient for forming the basis of a detailed monitoring plan. The phased approach for developing and implementing a plan over a 5-year period also seems to be mismatched with the rapidly increasing frequency and severity of CHABs and the general urgency of

addressing the extremely high concentrations of toxins that have been observed in some locations in the Delta. Considering the recommendations in the "Review of the Monitoring Enterprise in the Sacramento-San Joaquin Delta" authored by the Delta Independent Science Board in March 2022 may also be helpful.

11. There is a very large number of "special studies" proposed in the report. The final report should attempt to identify which of these are of higher priority, especially given existing funding limitations. If prioritizing the special studies is not achievable at this stage, at a minimum the strategy document should outline the criteria by which the special studies should be prioritized.

We also note that it is clear from the draft strategy that there is currently no funding to support the development of a detailed monitoring plan, let alone to implement it. While beyond the scope of the monitoring strategy document itself, we want to emphasize that securing funding for CHAB monitoring should be a high priority. In support of this goal, the connection between the potential funding approach and the regulatory framework for managing water quality and ecosystem protection in the Delta could be identified more clearly in the final strategy document.

Sincerely,

Anna M. Michalak, Ph.D.
Member, Delta Independent Science Board

Diane M. McKnight, Ph.D.
Member, Delta Independent Science Board