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January 21, 2022

Dr. Laurel Larsen, Lead Scientist  
Delta Science Program  
Delta Stewardship Council  
715 P Street, 15-300  
Sacramento, CA 95814

**Subject: Comments on Draft 2022-2026 Science Action Agenda**

Dear Dr. Larsen:

This letter originates from lands of the Lisjan Ohlones in the East Bay, of Yokut lands in the Stockton area, and Miwok lands of the Delta further north. These lands represent the great connections of the San Francisco Bay with the Delta estuary.

Restore the Delta (RTD) is a grassroots campaign of residents and organizations committed to restoring the Sacramento-San Joaquin Delta so that fisheries, communities, and family farming can thrive there together again; so that water quality is protected for all communities, particularly environmental justice communities; and so that Delta environmental justice communities are protected from flood and drought impacts resulting from climate change while gaining improved public access to clean waterways. Ultimately our goal is to connect communities to our area rivers and to empower communities to become the guardians of the estuary through participation in government planning and waterway monitoring. RTD advocates for local Delta stakeholders to ensure that they have a direct impact on water management decisions affecting the well-being of their communities, and water sustainability policies for all Californians.

RTD appreciates that the Delta Science Program reaches out to a community larger than just scientists to announce and share its Draft Science Action Agenda. The impulse to “co-produce” the action agenda (as the DSP refers to such engagement with publics beyond those with Delta science expertise and credentials) is a welcome gesture from the DSP. We are also grateful to the DSP for working to expand the scope of Delta science to include social science practitioners and discourses in the framing and, hopefully, resolution of Delta natural resource and climate vulnerability issues—many of which have social, political, and economic components and causal factors relating to risk. We wrote you about this particular science issue in relation to the Delta Independent Science Board assessment last month.

We have reviewed the Draft Science Action Agenda (DSAA) in some detail and provide general comments in this cover letter and more specific comments in Attachment 1.

## General Comments

Several of our general concerns below relate to the purpose of Delta Science Program under the Delta Reform Act of 2009. Chapter 2 of the Act states it is “the policy of the State of California...to achieve the following objectives that the Legislature declares are inherent in the coequal goals for management of the Delta,” including:

- Managing Delta water and environmental resources “and water resources of the state” over the long term.
- Protecting and enhancing unique cultural, recreational, and agricultural values of the California Delta as an evolving place.
- Restoring the Delta ecosystem as the heart of a healthy estuary and wetland ecosystem.
- Promoting statewide water conservation, water use efficiency and sustainable water use.
- Improving water quality to protect human health and the environment consistent with achieving water quality objectives in the Delta.
- Improving water conveyance and storage systems statewide.
- Reducing risks to people, property, and state interests in the Delta by effective emergency preparedness, appropriate land uses, and investments in flood protection. (Water Code sections 85020(a)-(g).)

The final objective in this section of the Act includes establishing “a new governance structure with the authority, responsibility, accountability, *scientific support*, and adequate and secure funding to achieve these objectives.” (Water Code section 85020(h) [emphasis added].) This is a key provision of the Act authorizing a role for the Delta Science Program as providing scientific support of other legislative objectives.

The Act further specifies as state policy a mandate to “reduce reliance on the Delta in meeting California’s future water supply needs through a statewide strategy of investing in improved regional supplies, conservation, and water use efficiency.” (Water Code section 85021.) Finally, the Act affirms that “the longstanding constitutional principle of reasonable use and the public trust doctrine shall be the foundation of state water management policy and are particularly important and applicable to the Delta.” (Water Code section 85023.)

The Act also states that “the mission of the Delta Science Program shall be to provide the best possible unbiased scientific information to inform water and environmental decision making in the Delta.” (Water Code section 85280(b)(2)(D)(4).)

We reiterate these objectives, policies, and missions of the Act, because it appears to us that the DSAA is silent on this legislative framework and appears to lose sight of the policy context in which the Delta Science Program is required by law to operate. We wish to be as clear as possible on this point: the Delta Reform Act has a set of policies that add up to a point of view—the Delta is in crisis, and the Council, supported by its Delta Science Program, has a duty to protect and conserve Delta natural resources and communities as evolving places.

Confusion sets in when the email promoting release of the DSAA states—seemingly as fact—that the DSP “provides the best possible unbiased scientific information to inform water and environmental decision-making in the Delta.”<sup>1</sup>

In this promotional context, we think the word “possible” here is an unfortunate and inaccurate choice for this type of publicity. It states as fact what is actually an aspirational legislative mission—that the Delta Science Program is to do the best possible scientific work it can. This is not the same thing as claiming that the DSP sponsors or is a repository of the “best possible unbiased scientific information to inform water and environmental decision-making in the Delta.” Objective science is an aspiration of the scientific enterprise (including the Delta Science Program), to counter through scientific method, discussion, debate, and confirmation the fact that all human beings are fallible and subject to bias. Science (including the Delta Science Program) is the journey, not the destination—truth is the destination, we hope. We’re glad you’re excited about the work you get to do, but it is important to stay humble and methodical about it.

We have encouraged the DSP to get out in Delta communities more, and integrate social scientists into its studies, and we are delighted the Program suggests several actions in this DSAA to increase their presence and influence. Applying and engaging our communities with social science methodologies represents a good first step along a path to build trust, and we appreciate that this DSAA moves in this direction.

We wish the DSP to be realistic about the conduct of science in the Act’s integrated policy framework. Dr. Larsen recognizes the existence of a regulatory framework that shapes Delta science efforts, as she states in her Foreword to the DSAA:

Not only can an action agenda specific to science provide the foundation for a science framework that supports decision-making,...it can also go a long way to ensuring the robustness and independence of that framework.

How does the SAA support the independence of science? First, it identifies and sets research and action priorities that transcend the jurisdictions, mandates, and decisional time horizons of individual agencies and establishes them as community funding priorities. Second, it empowers truly independent scientists—those not affiliated with a regulatory agency—to develop the key science relevant to management. Absent an SAA, independent scientists often struggle to identify those questions or studies that would most benefit immediate management needs because they may not know where to find the information, or they lack the time to do so. (As an academic who has been there, I know the struggle.) Though a robust body of science is performed by regulatory agencies, engaging independent scientists to identify and resolve scientific uncertainties underpinning

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<sup>1</sup> This quote is found in third column of the original email from the Delta Science Program, “Available for Public Review: Draft 2022-2026 Science Action Agenda,” 18 November 2021 (time stamp 1:12 PM) from [hello@deltacouncil.ca.gov](mailto:hello@deltacouncil.ca.gov). The full quote is: “The [Delta Science Program](#) provides the best possible unbiased scientific information to inform water and environmental decision-making in the Delta. One of the ways we carry out this mission is by facilitating the transparent and collaborative development of Science Action Agenda iterations.”

controversial and politicized decisions is critical for establishing trust in the scientific basis for decision-making.<sup>2</sup>

The “independence of science” Dr. Larsen referred to shifts about. The DSAA identifies and sets priorities for research content and funding that “transcend” the priorities and schedules of “individual agencies.” Then Dr. Larsen posits “truly independent scientists—those not affiliated with a regulatory agency—to develop the key science relevant to management.” She admits later in this quotation that by “independent scientists” she really refers to academic scientists. This appears to undervalue important work that government agency scientists perform. (Scientists for the US Fish and Wildlife Service and the National Marine Fisheries Service working on 2008 Delta smelt and 2009 Chinook salmon biological opinions, as well as agency scientists taken off the BO reconsultation processes in 2019, come immediately to mind.)

We certainly agree that an action agenda for science helps clarify research priorities that are determined by adopted policy and management needs. But we disagree that “independent scientists” (that is, academic scientists) are so vital to “establishing trust in the scientific basis for decision-making” in the case of the Delta. They may not be as close or as informed as agency scientists about implementation procedures, bureaucratic realities, or legal interpretations. Fifty years of both agency-based and academic-based scientists working in the open waters, wetlands, rivers, and sloughs of the Delta has succeeded in neither achieving “One Delta, One Science,” nor the prevention of Delta smelt and Chinook salmon from facing extinction, nor resolved how best to handle and remediate major stressors, such as invasive invertebrates, toxic cyanobacteria emergence, legacy contaminants, and submerged aquatic vegetation. It makes little sense to raise one class of scientists above another—both groups of researchers have much to contribute to scientific enterprise and have done so for decades. In short, this lends a tone to the DSAA of unjustified scientific hubris, privileging of careerism, and seeming, if unintended, indifference to real concerns of Delta communities and residents. Because of your stated intentions to integrate social science practice into DSP research priorities, we simply think you have been a bit over the top with your enthusiasm for the science the DSP sponsors.

Scientific research always occurs in some sort of political context and framework. Even Dr. Larsen’s “independent scientists” are beholden to conceptual frameworks that describe ecologies in ways that bear relationship to modern social and economic hierarchies. Food webs have analogous conceptual sequencing to industrial supply chains (in which energy assumes new forms much as input commodities are transformed to make different products before their final consumption). Hydrologists, civil engineers, economists, and financial analysts view storage reservoirs and financial accounts using some of the same language of withdrawals, deposits, depletions, exchanges, repayments, flows, savings, and so on. Other such reasoning by analogy is common in science—social as well as physical. Independence and objectivity are thus contingent. Academic scientists have “publish or perish” political imperatives that drive them to seek funding and status in their professional communities. The DSAA does the public no service by idealizing and obscuring political dimensions of the

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<sup>2</sup> Delta Science Program of the Delta Stewardship Council, *2022-2026 Science Action Agenda: Public Review Draft*, November 2021, p. 4. Accessible at <https://scienceactionagenda.deltacouncil.ca.gov/pdf/2021-11-17-2022-2026-saa-public-review-draft.pdf>.

conduct of science as a profession and a realm of truth. To deny the reality of political influence within science is to make a political decision.

Because the DSAA fails to hew explicitly to the DSP's and Delta Stewardship Council's regulatory framework, it appears to us untethered to already-established performance measures and policies of the Delta Plan. The framework could have and should have been an asset to ground scientific research priorities—Delta Reform Act policies and Council-formulated performance measures place bounds on and set agendas for the conduct of science under the DSP's auspices. Instead, it appears that the DSAA relied on the scientific community and unnamed managers to “co-produce” and determine DSAA research questions and terms by which social science integration is sought without clearly detailing connections with management-relevant policies and performance measures.

### **Concluding Remarks**

We found several DSC staff's concluding questions in their August 26, 2021, report to the DSC on social science integration adaptable to our general comments on the DSAA.<sup>3</sup>

#### **First, *what does success look like with this DSAA?***

Honestly, we're not sure because many of the management needs and questions are pitched at a high level of abstraction. It is also unclear to us why the DSAA has made no effort to frame more of the “management needs” to explicitly address legislated policies and objectives—which ought to be needs that DSC and other agencies' management teams must address, and **can** address precisely because they are authorized to. Yet the DSAA identifies no legislated policies and objectives, nor any DSC-adopted performance measures, to help guide and focus DSAA research priorities. We are mystified why this is not done by the DSP.

A prior question about success is, **whose** success are you as a state agency trying to achieve? Is the DSAA designed to benefit the health and success of the DSC and DSP as bureaucracies, with career and domain-building as the implicit primary concern? Or are the public's priorities for the Delta as reflected in legislated policies and objectives, which we described in our cover letter, the lode star for measuring success with this DSAA? We are truly concerned that for now it is success and health of DSC and DSP as bureaucracies that is the primary goal of the DSAA, rather than conducting research that helps address and create greater environmental justice, reduced Delta reliance for California's future water needs, and furthering of the co-equal goals in the Delta Reform Act.

#### **Second, *DSC staff last August asked, what types of integration activities should be prioritized?***

We believe the Delta resident survey is vital. We also think that a literature survey should be conducted that synthesizes the “literature” about the social life of the Delta, historically and in terms of social stratification and racial segregation. The DSC should also complete its vulnerability assessment and the remaining portions of the Delta Adapts process—and that the

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<sup>3</sup> Questions were stated at the conclusion of Delta Stewardship Council, Agenda Item 9: *Information Item: Delta Social Science Integration Update*, August 26, 2021, prepared by Jessica Rudnick and Cory Copeland. Accessed at <https://deltacouncil.ca.gov/pdf/council-meeting/meeting-materials/2021-08-26-item-9-social-science-integration-staff-report.pdf>

DSP's science action priorities need to pay closer attention to knowledge gaps that emerge from both the vulnerability assessment and the adaptation strategies over the next year. The DSAA also must become better integrated with DSC legislated and adopted policies, objectives, and performance measures so that scientific research is focused for greater relevance to management needs and management questions. Finally, we urge that there are existing gaps which were touched on in the DSAA relating to control, elimination, and management of harmful algal blooms in the Delta, and that these research efforts be integrated with insights gleaned from implementation of Ecosystem Amendments to the Delta Plan that result in concrete restoration projects and their impacts to social and economic factors in Delta communities, urban and rural, historical and recent.

The final question we adapt for this conclusion is, ***What is the Delta's socio-ecological baseline?***

How has the profile of environmental justice communities changed since 2014 (when RTD documented its presence in the California WaterFix change petition hearing)? We support the DSP's interest in and willingness to produce new knowledge and insights about the Delta, and our staff welcomes participating in those processes. We also think much more could be done to synthesize existing data sources—particularly census data, data from the US Bureau of Labor Statistics, the California Employment Development Department, Franchise Tax Board, Department of Finance, and other existing sources—as a basis for generating additional information about what gaps in knowledge exist for the Delta economy and its relationship to Delta ecology. Which industries are most dependent on water, and are they direct or indirect in their reliance? What are the educational deficits of the Delta region and how might they be overcome so that educational achievements are turned into assets? What investments could achieve that while also achieving DSAA aspirations to build public trust in government and science, increase scientific literacy, and encourage civic engagement (see Science Action 4B)?

Thank you for the opportunity to comment on the DSAA.

Sincerely,



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Attachment: Specific Comments by Restore the Delta on the Draft Science Action Agenda

cc: Susan Tatayon, Chair, Delta Stewardship Council  
Virginia Madueño, Vice-Chair, Delta Stewardship Council  
Frank C. Damrell, Member  
Mike Gatto, Member  
Maria Mehranian, Member

Christy Smith, Member  
Daniel Zingale, Member  
Erik Vink, Delta Protection Commission  
Dillon Delvo, Little Manila Rising  
Matt Holmes, Little Manila Rising  
Jasmine Leek, Third City Coalition  
Tama Brisbane, With Our Words      Thomas H. Keeling, The Freeman Firm  
Kelley Taber, Somach & Simmons  
John Herrick, South Delta Water Agency  
Dante Nomellini, Central Delta Water Agency  
Osha Meserve, Soluri Meserve LLC  
Roger Moore, Law Office of Roger B. Moore  
Jonas Minton, Planning & Conservation League  
Bob Wright, Sierra Club California  
Bill Jennings, California Sportfishing Protection Alliance  
Chris Shutes, California Sportfishing Protection Alliance  
Carolee Krieger, California Water Impact Network  
Michael B. Jackson, California Water Impact Network  
Barbara Vlamis, AquAlliance  
Regina Chichizola, Save California Salmon  
Tom Stokely, Save California Salmon  
Patricia Schifferle, Pacific Advocates  
Brandon Dawson, Sierra Club California  
Adam Keats, Law Office of Adam Keats, PC  
Doug Obegi, NRDC  
Kate Poole, NRDC  
Jon Rosenfield, San Francisco Baykeeper  
Gary Bobker, The Bay Institute  
Mike Conroy, PCFFA  
John McManus, Golden State Salmon Association  
Michelle Ghafar, Earthjustice  
Nina Robertson, Earthjustice

**Attachment 1**  
**Specific Comments by Restore the Delta**  
**on the Draft Science Action Agenda**

Restore the Delta's comments are organized by Management Need number as those are found in the DSAA.

- *p. 6, Management Need 1:* We are surprised in this management need's 1C at "identify and carry out large-scale experiments that can address uncertainties in the outcomes of management actions for water supply, ecosystem function, and socioeconomic conditions in the Delta." We are concerned about what is meant by "large-scale experiments." In our view, this raises serious ethical concerns about conducting experiments on an integrated regional ecosystem and economy and social system that should seek the consent of those communities that will be affected by such large-scale experiments. At a minimum this statement requires further elaboration.

Our concerns are hardly allayed when the DSAA asks (p. 19): "How can large-scale experiments (e.g., pulse flows, aquatic vegetation removal) be coordinated among stakeholders and implemented to test conceptual model assumptions and hypotheses and to inform future management?" This question is followed by "What key psychological, social, and structural barriers inhibit institutional learning, coordination across diverse stakeholders and agencies, and collaborative management in the Delta?" Together, these two questions are so abstract as to mean possibly anything. There is no accompanying connective discussion regarding why pulse flows or vegetation removal should be characterized as example topics of "large-scale experimentation." There is also no description as to the baseline condition of "inhibited institutional learning" in the context of the Delta. Who has been inhibited, how, with what costs, and why? The Delta Stewardship Council prides itself, with some reason, on being a reasonably transparent state agency on Delta matters, but the Delta Science Program's descriptions in the DSAA can be exceedingly opaque. Our point here is that so many of these types of management questions are pitched at such a high level of abstraction in the DSAA with no attempt to connect them to actual research areas (e.g., water quality, fish population abundances, economic poverty, community risk).

- *p 21, Management Need 2, Science Action 2A:* We of course agree there is a need for more science-based tools to manage harmful algal blooms that amount to HABs forecasting (monitoring all factors' preconditions, sampling of key locations on site, and communicating impacts and warnings to the community). But we could not find a useful definition of "interoperability" in the DSAA, which is part of the description of Management Need 2. This is symptomatic of the DSP's tendency to groove on its role as a science-fostering agency while failing to ensure that it translates scientific jargon into plain English for lay readers (and who yet may also have some scientific background but are not career scientists). The DSP is not "Club Science." It is a public entity dedicated to doing the public's scientific research to support the policy programs of the Delta Stewardship Council. Please unpack your jargon. What is the difference, if any, between interoperability and integration? Please define in the final Science Action Agenda later this year.

Related to Science Action 2A (p. 21), who is to develop the framework for monitoring, modeling, and information dissemination in support of operational forecasting concerning HABs? Is the DSAA contemplating "independent" academic scientists being the repositories

of this framework? Or does the DSP recognize that Region 5 Water Board is working with Restore the Delta to build the latter's capacity not only to monitor HABs in the Delta, but train young people from environmental justice and disadvantaged communities here to do that work and help interpret results? We know that the DSC's planning unit is aware of these efforts from having collaborated with us on the Delta Adapts process and on a presentation of RTD's HABs water quality monitoring work before the most recent State of the Estuary conference on October 1. The DSAA betrays no awareness of the DSP about these relationships in Management Need 2.

- *p. 22, Management Need 2, Science Action 2B:* This action relates to enhancing “flood risk models through a co-production process with Delta communities...” Since many interested individuals and communities at risk of flooding are disadvantaged/environmental justice communities, we urge that the final Science Action Agenda recognize the need to budget for and provide to your “co-producers” adequate, even generous stipends to ensure participation. Community participation means devoting time, and time involves costs—of child care, time away from work, and so on. Respect these community representatives by ensuring they are fairly compensated for providing DSP and DSC researchers with their insights and experiences.
- *p. 22, Science Action 2D:* This action centers on improving forecasting capabilities. We agree this is essential given that climate change is affecting weather patterns, hydrologic precipitation and runoff, ecosystems, and water quality conditions “at various spatial and temporal scales.” DWR and the Bureau suffered a major forecasting mishap last spring when some 800,000 acre-feet of anticipated runoff from April snowmelt failed to materialize in north state reservoirs. Existing gaps the DSAA identifies for this action include “forecasts of temperatures, habitats, and fish conditions,” but should be extended to include soil moisture conditions, study of “thirsty air,” and water rights allocations by the State Water Project and Central Valley Project.
- *p. 23, Management Need 3:* This management need is stated as “Expand multi-benefit approaches to managing the Delta as a social-ecological system.” The accompanying narrative says this need is intended to focus on “how the Delta could be managed more holistically as a social-ecological system, in a way that is cognizant of interactions among its human, non-human, and physical components across spatial and temporal scales.” What does the DSAA mean by “holistically managing the Delta as a social-ecological system”? Are state and local jurisdictional mergers in order, since there are five counties, numerous incorporated cities (including Isleton in the central Delta), a few dozen reclamation districts, school districts, at last estimate a couple of dozen state and federal resource and scientific agencies with some type of role in managing and manipulating Delta resources? What is the scope (in breadth and depth) of a “social-ecological system” in this context? Again, DSAA reliance on scientific jargon renders opaque what could be provocative and interesting discussions about how best to govern the Bay-Delta estuary going forward and what research gaps need to be filled to clarify this area's questions and needs.

We agree there are needs for “multi-benefit” approaches to Delta problems and issues, and so we think Science Action 3A, should be tweaked somewhat. We suggest this action should read: “Conduct studies to inform restoration **and community protection** approaches that are resilient to interannual hydrologic variation and climate change impacts.” This

suggestion should build on the DSC's Delta Adapts vulnerability assessment, which highlighted numerous populations who are vulnerable, and less resilient, than others within the Delta. This is an instance where the DSP could have checked in with other units (such as DSC's planning office) that might appreciate additional scientific support and coordination. It is unclear at best that academic scientists would be as knowledgeable about what support is needed by the DSC for increasing Delta climate change and community resilience.

In connection with Action 3A, Science Action 3C appropriately calls for studies of environmental justice communities' benefits and costs associated with ecosystem restoration projects, and the "Existing Gaps" discussion points in this direction as well. We appreciate that recognition. Still we think that our Action 3A suggestion is important because ecosystem restoration and community protection is vital to long-term climate adaptation and resilience.

- *p. 24, Science Action 3D:* This action item would sponsor research into "minimizing introduction and spread of invasive species, and to inform early detection and rapid response strategies." While we recognize that climate change poses threats of additional invasive species arriving in the Bay-Delta estuary, this action does little to direct scientific attention to the major nonnative invasive species already in the Delta and which pose significant management challenges to Delta water resource management and endangered species conservation—specifically, submerged aquatic vegetation and *Potamocorbula amurensis*, the Asian clam. Are there potential predators or consumers for nonnative invasive species that could be introduced without creating additional ecological havoc? The Asian clam is a known and prodigious bio-accumulator of selenium in Delta and lower San Joaquin River waters. Can some means be devised through scientific research to harvest and purge these clams of selenium and establish a market for human or livestock consumption of their edible biomass?
- *p. 26, Management Need 4:* In the narrative, Dr. Jessica Rudnick is quoted saying, "the social sciences can help us understand how people living, working, and recreating in and around the Delta view and interact with the system, how the Delta impacts their health and well-being, and how their behaviors influence environmental issues." We agree that social scientists employing transparent, ethical, and suitable methods can increase knowledge and understanding about Delta communities, but we would like the DSP through the DSAA to reflect in writing on just who "us" is in "the social sciences can help us understand..." This goes to the purpose of scientific research sponsored by the DSP: Is it to increase the power of the state over communities in the Delta so that more water can be exported and carbon capture and storage plants are developed with less effort to mitigate their impacts on Delta communities, or is the purpose to identify needs and desires of Delta communities for their own improvement as communities of the wealthiest state among the United States? Is the purpose for money and power or for the improvement of people and their communities? Who matters more here? Who is "us"?

We also note in this management need discussion (for example in Science Actions 4A through 4C) an emphasis on development of new knowledge without also acknowledging the role that study of existing data sources—some with relatively long time series, like the U.S. Census and its associated agricultural census and irrigation surveys, labor statistics, as well as community archives of records and imagery—might yield for historical insights as

well as identification of data and knowledge gaps about Delta communities that new research may build on. In this regard, Science Action 4B's acknowledgement that "Retrospective assessment of co-production of community science in the Delta have been limited," we appreciated somewhat. But then the existing gaps discussion becomes abstract once again in calling for "studies that measure and evaluate the effect of utilizing co-production and community engaged science approaches on outcomes of interest, such as building public trust in government and science, increasing scientific literacy, and encouraging civic engagement." If you're intending to build the Delta public's trust in government and science, it will be crucial for the DSP and the DSC to lift up community concerns, to foreground them as key to recovery of endangered species and ecosystems as well as the Delta as an evolving place and the Delta's regional economy and impoverished communities, which have struggled throughout the COVID pandemic and faced a deficit of experiencing nature in their midst and nearby in the physical Delta.<sup>4</sup> One good place to start is the the existing data you have at hand, integrated with the above-suggested literature survey.

- *p. 28, Management Need 5:* Within the narrative of this management need there appears a definition of the term "stressor": "Here, 'stressor' is defined as any factor that affects the behavior, health, or fitness of a target species." Restore the Delta wishes to report a stressor lacking previous scientific attention and analysis—and is therefore an "existing gap" worthy of consideration in the DSAA—for the runs of Chinook salmon that have historically frequented the Sacramento River basin. This stressor is also an opportunity to integrate social science and legal research with natural and biophysical science research. This new stressor is the prior appropriation water rights system as administered by the State Water Project and the federal Central Valley Project on behalf of settlement and exchange contractors. Last spring, the two projects had in excess of 4.5 million acre-feet in storage by April, and faced with temperature management issues with protection of expected hatching of Winter-run Chinook salmon along the Sacramento River chose to deliver nearly 60 percent (or nearly 2.6 million acre-feet) of their stored water to these contractors whose farmers produce rice and almonds for export from the Sacramento Valley. Over the summer, fisheries biologists determined that over 98 percent of juvenile Winter-run Chinook salmon fish perished in the wake of these flows being diverted elsewhere in the Valley out of the Sacramento River. It seems apparent, then, that hidebound application of the prior appropriation water rights should be scientifically and officially viewed as a stressor—a social and institutional factor in the Delta watershed that negatively affects the behavior, health, and fitness of Chinook salmon populations in the Sacramento River basin. We request that the DSP add this to the DSAA as an urgent area for both retrospective and future research toward supporting salmon survival. This would be a highly relevant and practical area of research that bears on many management questions and needs, especially since reasonable use and public trust doctrines are foundational to the achievement of the coequal goals in the Delta watershed. We can put you in touch with Indian tribes, commercial fishing interests, and communities of sport fishing anglers who would be

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<sup>4</sup> In this light, social science can be important in evaluating the importance of universal benefit income programs in stabilizing family incomes sufficient to afford recreational and educational opportunities that reduce their deficits of nature experiences and increase their scientific literacy. Data capture by the City of Stockton's UBI "experiment" during the administration of Mayor Michael Tubbs would be important to such a social science endeavor.

pleased to help “co-produce” such research with DSP-funded scientists. Our contact information is with our signatures above.

- *p. 29, Science Action 5A:* This action calls for improving control and management methods for invasive aquatic vegetation under climate change conditions. We support this action, but we find the existing gaps associated with this action are insufficiently specified. We remind the DSP that increased flows can be an important factor (we acknowledge not the only one) in clearing out and destabilizing invasive aquatic vegetation. The obverse of flow is the residence time of water—a measure of stagnation, or ongoing residence of specific blocks of water in a particular water body—and should also be studied as a factor in establishing the conditions that enable invasive aquatic plants to gain footholds in Delta channels.
- *p. 29, Science Action 5C:* We applaud the DSP’s action to “identify the drivers and impacts of HABs severity and persistence.” We think the “existing gaps” discussion overstates as “elusive” the causes, health impacts, and effective management of HABs and their toxins. The factors that lead to (“cause”) HABs are well summarized in the literature; they have not eluded researchers. Lacking are full-fledged monitoring regimes with stable organizations staffing them to collect data on their presence, mechanisms of spread, their health impacts, and effective management and even mitigation or elimination where possible. It is well known, for example, that flushing flows from storm runoff helps remove blooming cyanobacteria from open water. Equally important, however, will be to study what kind of bottom surface conditions contribute to HAB mat formation and persistence. Will scouring flows be important to eliminating their threat, and if so, what amount of flow will be necessary to uproot and flush such mats downstream and even beyond to the Pacific Ocean?<sup>5</sup>

This existing gap discussion also neglects that, among the potential health impacts of HABs, individual cells of cyanobacteria may become airborne at the water surface and become lung irritants when inhaled by animals and humans, with other potential resulting health impacts that may be distant from their original source. This toxic air pollution threat from continued spread and recurrence of HABs in Delta water ways has the potential to compromise public health in every direction the wind blows through the Delta. We understand the DSP is already involved in a study on the link between cyanobacteria and air quality. This should be documented in Science Action 5C. This is an “existing gap” in Delta-based scientific research that the DSAA should seek to fill when its final version is completed and released in a few months. RTD stands ready to collaborate to help co-produce such research with the DSP, along with Region 5 of the Water Boards.

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<sup>5</sup> Scouring flows through the Delta were likely important in February 1986, an event that disrupted the prior benthic invertebrate regime of the western Delta and provided *P. amurensis* with its colonizing opportunity in 1987 when it arrived in a ship’s ballast water. That same flood event, it also bears recalling, flooded two North Delta islands (Tyler and Prospect) and three tracts (McCormick-Williamson, New Hope, and Glanville). The magnitude of this flood event could represent, with some study, a comparative metric as to how much scouring flow would be needed to uproot HAB mats. See F.H. Nichols, J.K. Thompson & L.E. Schemel, 1990. Remarkable invasion of San Francisco Bay by the Asian clam, *Potamocorbula amurensis*, of a former community. *Marine Ecology Progress Series* 66: 95-101. Accessible at <https://www.jstor.org/stable/24844649?refreqid=excelsior%3Ab395e7a0c88754c28de1d3e6bd9ab2d5>; and California Department of Water Resources, 1995. *Delta Atlas*, “Recent Flooding, 1967-1992,” PDF page 59, paper page 48.

- *p. 31-33, Management Need 6:* This management need addresses assessment and anticipation of climate change impacts and support of successful adaptation strategies. We appreciate that this need is identified and handled more concretely than are other areas of need. Science Action 6A, however, appears to exclude human communities from its attention to sea level rise and weather/climate extremes impact habitats, water quality and sediment supply changes, and other physical and biotic factors in the Delta. We are unclear why human communities are omitted from this particular action item when most other science action items under this need area include human communities in their scope.

Science Action 6C concerning groundwater recharge for improved ecological functions and water resilience under various scenarios implies acceptance by DSP officials of the California Department of Water Resources presumption that there is surface water available for replenishment from the Sacramento River basin which would be imported from the Delta. When the “existing gap” narrative states that “Some studies of the benefits of groundwater recharge for ecological and economic benefit have occurred,” it is obscure and opaque what the source of recharge is. Is recharge assumed to occur in-basin, or are inter-basin transfers involved, such as from the Sacramento Valley to the San Joaquin Valley via the Delta? Does the narrative’s statement that “more region-specific studies” are needed to “understand multiple impacts of groundwater recharge projects” so that they are “response to SGMA implementation and the 2020 Water Resilience” based in a definition of “region-specific” as the whole Central Valley (connoting inter basin transfers from Sacramento Valley to the San Joaquin), or would these studies take each basin individually, reflecting more of a self-sufficiency model of the potential for recharge within (rather than across) individual basins?

Finally, regarding Science Action 6E, we urge the DSP to consider research proposals that evaluate the actual diversions and allocations conducted by the State Water Project and Central Valley Project under their Temporary Urgency Change Petition and impacts of their operations on ecological flow and Chinook salmon habitat in the Sacramento River Basin and its once-productive salmon tributaries. This is urgently needed to understand exactly what occurred in 2021 and to reduce, mitigate, and avoid having the prior appropriation water rights system act as an institutional stressor on Chinook salmon populations as they did last year, and threaten to do again this year.

In relation to this, a useful literature survey would be to study alternatives for large-scale water systems to plan adequately for drought period supply an water quality objective compliance so that temporary urgency change petitions may be avoided in the near- and long-term futures.