South Bay Salt Pond Restoration Project

Restoring the Wild Heart of the South Bay

Science Technical Advisory Committee

Tuesday, August 1, 2017

9:30 a.m. – 4 p.m.

Elihu M. Harris State Office Building
1515 Clay Street, 2nd Floor, Room 10
Oakland, California

Objectives: The purpose of the Project's Science Technical Advisory Committee (TAC) is to provide guidance to the Project Science Program, management team, and land managers; to assess progress of Project restoration; and to advise on adaptive management. The formation of a TAC also fulfills the water quality certification requirements for Project restorations. The goals of this meeting are to review and provide input on the Project's Phase 1 science summary and how the Project tracks the status of key scientific uncertainties, and to provide an assessment and recommendations on the proposed approach to the Phase 2 science program.

Meeting Attendance: Attachment 1 lists meeting participants.

Meeting Materials: In advance of the meeting, TAC members received a description of the draft Proposed Phase 2 Science Approach, a table of the key uncertainties and Phase 1 applied studies, the draft summary of Phase 1 science work, and a chart summarizing PI/PMT scoring last year on trends in addressing Adaptive Management Plan key uncertainties. In addition, the Project offered an optional webinar to background TAC members for the meeting.

Appendix A: Appendix A lists Phase 2 design alternatives.

Key TAC Recommendations

- Phase 1 Science Summary
  - Include more detailed/descriptive text explaining and clarifying the areas of remaining uncertainty; and
  - To better indicate the status of overall Project progress for each topic, consider including the data used for each target/trigger analysis for topic areas (where available) to indicate status of progress.
- Key Uncertainty Questions
  - Consider altering question phrasing (from the original Key Uncertainties as outlined in the FEIR/S) to be more consistent and clear; and
  - Consider reframing key uncertainties to more broadly incorporate sea level rise, climate change and other broader external factors.
- Stoplight Chart
  - Category definitions seem to incorporate multiple factors in a way that is not entirely clear; consider reformulating and clarifying language, presentation and definitions;

    - Consider adding medium- and long-term scores and place within a temporal frame
- Phase 2 Science:
    - Better define integration;
    - Consider building scientist information-sharing and collaboration into RFP process;
    - Consider organizing around a "sandbox" event or location as an integration tool;
    - Coordinate with North Bay projects to enhance regional information-sharing and integration; and
    - Incorporate multiple approaches to achieve integration of Phase 2 studies.

Action Items

Follow-up items for the Project include:

1. Contact Susanne von Rosenberg to 1) identify key potential partners in the North Bay for integrated regional data studies and approaches in Phase 2 of the Project; and 2) discuss the framing of policy implications in the sediment section of the draft Phase 1 science summary (and how to use in Phase 2 science planning).
2. Contact Kristin Byrd about 1) how to integrate the stoplight scoring system with a map showing uncertainty geospatially; and 2) the USGS Innovation Center partnership with NASA-AMES to explore options for Phase 2 integrative studies.
3. Follow up with Jeremy Lowe about ideas on how to update and frame the topic of climate change/sea level rise (SLR) in the draft Phase 1 science summary.
4. Consult with Mike Vasey and Jeremy Lowe about other restoration efforts the Project can benefit from learning about (e.g. SF Bay National Estuarine Research Reserve (NERR) sentinel site program).
5. Follow up with Chris Barr about the sentinel site discussion invitation from NOAA.
6. Follow up with Tom Gandesbery about Sonoma Baylands report.
7. Consider revising the stoplight scoring chart, the Phase 2 draft approach, and the draft Phase 1 science summary to reflect TAC member input.
8. Circulate the draft meeting summary, once developed.

Context for the Day

John Bourgeois, Executive Project Manager, noted that the TAC, which last met seven years ago, serves as a body of independent experts to advise the Project and Project Lead Scientist – a role that is currently unfilled. The TAC charter includes a conflict of interest stipulation – the TAC is strictly an independent review entity, as opposed to the scientists who are funded to do work directly for the Project.

Participants introduced themselves and John Bourgeois reviewed the agenda and meeting objectives. Ariel Ambruster, lead Project facilitator, reviewed material provided to TAC members in advance of the meeting that would be the subjects of the day's discussions. Other attendees were in the room to observe.

Project Phase 1 Review and Assessment

John Bourgeois provided a brief overview of Project history and Phase 1 accomplishments.

- The Project, started in 2003, represents a landmark public-private partnership for restoration of over fifteen thousand acres distributed across three distinct pond complexes in three counties owned by two separate landowners.
- The many uncertainties associated with the Project's path to meet its goals and objectives drove the decision to conduct the Project in phases coupled with scientific studies. A key driver

is the idea of ecological trade-offs, particularly between the habitats needs of tidal marsh species, such as Ridgway's rails, versus the needs of pond species, such as western snowy plovers. The overall restoration approach is guided by the need to balance the amount of tidal marsh and ponds. The Project plan ranges from a minimum ratio of 50:50 (tidal habitats: ponds) to a maximum of 90:10. Science and monitoring will determine what the final ratio is.

- Phase 1 accomplishments include the restoration of 1600 tidal acres, 1440 muted tidal acres, 710 acres of reconfigured ponds, and seven miles of new trails. As of the completion of Phase 1, 25% of ponds are in some form of restoration, while the rest are managed ponds. Phase 1 represents 10% progress along the trajectory to full restoration.

Phase 1 Science Summary

John Bourgeois explained the approach in Phase 1 identified the easiest restoration projects to implement (i.e. low-hanging fruit) and addressed the most difficult scientific uncertainties and questions through experiments. Project Phase 1 products include the Phase 1 science summary (which is moving forward as an Open File Report by USGS), and a public-facing document providing more accessible information and assessment of the Project's progress. The summary is an effort to memorialize the science, communicate to the public, and inform Phase 2 science.

Discussion and Comments on the Draft Phase 1 Science Summary

- TAC members agreed the overall approach to the summary was sound and communicated the science well.
- One TAC member commented on the tendency to describe the Project as progressing toward an "endpoint," and instead suggested framing the progress more as an "evolution" of the landscape.
- Several TAC members suggested adding more information and context about the Project overall and more visual illustrations (e.g. visually linking the uncertainties, research questions, and management responses; more Phase 1 Project maps).
- One TAC member suggested integrating Project maps with the stoplight scoring system to show the geospatial distribution and variation of results and uncertainty of each topic area.
- TAC members made several comments about the language and wording of Key Uncertainty questions. They suggested avoiding the writing style common in technical Environmental Impact Reports prepared for CEQA, and instead rewording the questions and uncertainties to clearly communicate what constitutes positive or negative outcomes and/or progress. For example, the section on mercury seems to indicate things are not going well. John Bourgeois clarified that the questions are verbatim from the original Project programmatic environmental document.
- One TAC member commented on the policy implications of the conclusions in the sedimentation section. The conclusions about the sedimentation rates in the South Bay versus the North Bay have the potential to drive investment decisions. However, there are still many unanswered questions in the sedimentation section that need clarification. When there is the potential to significantly impact policy, it is important to be very clear about the level of uncertainty of the conclusions.
- One TAC member commented that the stoplight assessment did not seem adequately quantitative or granular, and suggested adding more detailed numbers about the thresholds and targets that were originally developed for the Project to all sections of the Phase 1 Science Summary document. Another TAC member suggested adding the description of the stoplight

scoring approach from the March 2016 PI/PMT meeting notes for those interested in the methods and data used.

- TAC members discussed how climate change and SLR were addressed in the summary. They suggested thinking through whether it is a separate section or if it should be incorporated throughout. John Bourgeois commented that the thinking and data on climate change and SLR has shifted since the beginning of the Project and has become much more salient. One TAC member noted that the SLR section primarily focuses on sediment and would fit well in the sediment section.
- A few TAC members commented that the baseline comparison points and the timescales of interest were not clear. They suggested deciding on the timescale of interest to help determine how to incorporate climate change issues. All documents (i.e., the Phase 1 science summary and any info sheets) should consistently include the timeframe of interest. (Implicit in this request and in the discussion (though only hinted at in any explicit manner) was the point that the most relevant time frames are different for the various Key Uncertainties / Science Questions and for the different items being measured in the stoplight chart.)

Phase 1 Stoplight Chart

John Bourgeois reviewed the stoplight scoring chart and explained how it was developed. The PMT and principal scientists for the Project regularly convene to discuss results and evaluate monitoring efforts. The 2016 PMT/PI meeting focused on assessing where the Project was in the adaptive management cycle and developing a simple way to communicate the progress. Given how difficult it was to quantify progress, the stoplight chart was developed to provide a qualitative evaluation.

He explained that the goal of the Project is to improve conditions, avoid significant impacts, and reach restoration targets. For each target, there is a baseline, trigger number, and threshold of significance. If the trajectory moves toward a trigger, then the PMT will likely make a management change to correct the direction of the trajectory. Laura Valoppi, then lead scientist, and the Project developed a five-color stoplight based on tracking monitoring parameter values over time. Red means the monitoring parameter values indicate conditions are not meeting expectations, orange means trending negative, yellow means uncertain, light green means trending positive, and dark green means meeting or exceeding expectations.

PI/PMT analysis of Phase 1 restoration targets resulted in the following scoring distribution:

- Two clear **meeting or exceeding expectations** (marsh accretion rates and snowy plovers);
- A majority of targets **trending positive**;
- Four **uncertain** (California gulls, California least terns, water quality—regulatory objectives, and steelhead);
- One **trending negative** (water quality—algal composition issues); and
- Two **not meeting expectations** (short-term/construction mercury effects, reconfigured nesting islands).

Cheryl Strong, Refuge biologist, reviewed the California gull score of **uncertain** in more detail.

- Key study question: Will California gulls, ravens, and crows adversely affect (through predation and encroachment on nesting areas) nesting birds in managed ponds?
- California gull populations have experienced exponential growth since the 1980s.
- Data were collected from 2005-2006 for avocets, 2010-2011 for terns.

- Data show that 54% of radio-tagged tern chick deaths were caused by gulls (i.e. radio tags were found in gull nests).
- The Forster's tern chick survival to fledgling rate was 22%; for avocets it was 6%, 40% for stilts.
- Stilts fledged more chicks than avocets even though there were more avocet nests. Gulls caused 55% of avocet chick death, 15% of stilt chick deaths.
- Pond A6 was home to the largest gull colony in the Project, South Bay. Gull colony relocation in 2010 had a positive impact on tern chick survival. However, the short-term disruption of the gull colony did not significantly reduce gull populations.
- The data indicate that there are individual gulls that specialize in predation of Forster's tern and avocet chicks. A majority of the chick radio tags were found in only one or two gull nests.
- The difference in stilt chick survival rate as compared to avocets and terns may be explained by differential habitat use (i.e. stilts go into vegetative cover areas; avocets and Forster's terns do not use vegetative cover).
- The current answer to the study question is: yes, gulls are effective predators of water bird chicks and eggs. Gulls also displace other species from preferred nesting sites.
- The PI/PMT scored this target **uncertain** because, while the data show there is an impact, it is unclear if or how Project activities and management actions are having an effect on gull populations. That is a question the Project did not have sufficient data to answer. Several TAC members pointed out that this is a problem with the wording of the question itself. Project scientists do not know why gull populations are increasing.

Clarifying Questions and Comments on Gull Predation Studies

- The Project's gull relocation actions have had an impact on Cargill's ability to maintain levees. There are now nesting colonies in operating ponds. Cargill is having to change levee maintenance protocols including delaying maintenance in the salt-making ponds.
- The data seem to clearly show an adverse effect. Why was this scored **uncertain** and not **trending negative** or **not meeting expectations**?
    - John Bourgeois: We knew going in to the Project that there was an adverse trend from gull predation, but the Project's questions were more about whether the Project's actions were causing that trend to be worse than it would be otherwise. That is the question we did not think we could answer. We did not feel it was clear that our restoration actions were making gull-related conditions worse.
    - Follow up comment: The question needs clarification that adverse effects are being analyzed in relation to the restoration activities.
    - John Bourgeois clarified that the stoplight scores represent a snapshot in time of 10 years into a 50-year project, and the scores do not mean that the PMT will not continue to manage for improved conditions.
- It might be valuable to find a way to devote funding to study the gull problem. Add a footnote in the Phase 1 science summary about the regional gull population for better context.

Rachel Tertes, Refuge biologist, reviewed the western snowy plover score of **meets/exceeds expectations** in more detail.

- Key study question: Will shallowly flooded ponds or ponds constructed with islands or furrows provide breeding habitat to support sustainable densities of snowy plovers while providing foraging and roosting habitat for migratory shorebirds?
- There are ecological trade-offs between rails and plovers.

- The data indicate the population is positively trending toward the target of 250 individual breeding birds. The target represents the recovery goal over the 50-year Project timeframe.
- The PMT has taken various actions to improve conditions, including habitat enhancements (e.g. nesting islands), social attraction experiments (not successful), predator video monitoring, weed management, water management, and seasonal closure of public trails.
- The progress on western snowy plover populations was scored as **meets/exceeds expectations**. However, this evaluation only represents a moment in time and conditions may change in the future.
- There are still ongoing challenges, including high predation rates, aging pond infrastructure, and data collection issues. For example, the fledgling-to-male ratio is a strong indicator, but the data are hard to obtain. Moving forward, the PMT wants to combine approaches, try to get better data, and be more creative with modeling and metrics.

Clarifying Questions and Comments on Western Snowy Plover Studies

- What might explain the plover population increase?
    - Response: Habitat enhancements such as shell plots have been successful in increasing density in certain ponds. However, density increases are not necessarily sustained over time. i.e., predators eventually find the nests. We have not been able to fund predator management at Eden Landing. Monitors are finding more nests, more predation, and re-nesters. Snowy plovers change where they nest due to changing habitat, and move a lot annually.
- Is the highest predation coming from the gulls?
    - Response: Not always—there are also ravens and red foxes. The types of predations depend on the property and adjacent land use. There is a wide range of predator management actions. Since we are better at mammalian predator management, the most impactful predation is predominantly avian. The monitoring cameras show a lot of avian predation.

John Bourgeois reviewed the mercury studies' score of **not meeting expectations/trending negative** in more detail.

- Key study question: Will mercury be mobilized into the food web of the South Bay and beyond at a greater rate than prior to restoration?
    - Will pond management increase methylmercury levels in ponds and pond-associated sentinel species?
    - Will tidal habitat restoration and associated channel scour increase methylmercury levels in marsh and Bay-associated sentinel species?
- There is a legacy of mercury in the ponds, creek beds, and sloughs, and the PMT wanted to make sure actions did not make conditions worse.
- Several test and control sites were included in the studies:
    - Breach points in Pond A6.
    - Pond A8 (mercury "hotspot"). The A8 notch system has created a reversible muted tidal system. There are monitoring stations within the ponds to track the impact of opening the weirs.
    - Ponds A3N and A16 were used as negative and positive control sites (respectively).
- Before construction and notch openings there was a lot of variability in mercury levels. Mercury levels generally stabilized after the Project opened the notches.

- Alviso Slough experienced an increase in mercury levels after construction and the opening of notches, but has been observed to match the trends in the reference areas.
- The PMT knew scouring was going to occur and tried to model it beforehand. More scour occurred by the mouth of Pond A6 and not close to the notch openings.
- The data indicate that mercury is being mobilized more so during the winter during storm systems and is less driven by notch opening or closing. So, the Project is causing some small effects on mercury from scour, but less than projected at the outset and less than natural factors.
- Mercury is being mobilized in the study areas, but less than the amount projected in the environmental impact documents. Mercury mobilization does not seem to be solely linked to management actions.
- During construction and initial opening of notch gates, scientists noted increased mercury concentrations in fish, but then decreases over time. This initial spike was also noted in tern eggs.
- The PI/PMT decided that short-term negative impacts were **not meeting expectations** and the relative scale of impact was high (e.g., mercury concentrations in tern eggs). However, the long-term impacts seem to reduce concentration variability and methylation rates, which is a positive trend.

Clarifying Questions and Comments on Mercury Studies

- Mark Marvin-DiPasquale commented that the short-term increases in mercury were not surprising. Since the full opening of A8 notch gates, there is no evidence of long-term negative impacts. The upper part of Alviso Slough has more buried mercury, and with changes in the slough channel structure, there is the potential to hit a very "hot zone" that cannot be contained. There are still many uncertainties related to bathymetry stabilization in the slough, and to mercury issues overall.
- TAC members noted that there is no absolute threshold of causing problems, so there is no way to be sure that the spike-and-collapse dynamic is not causing a problem (i.e., there is no tipping point; the Project might be crossing a line without knowing it).
    - Related to that, what if scour proceeds until it hits a zone with a lot of sequestered mercury and then releases the material? It could be a worse spike than the ones observed previously.
- John Bourgeois emphasized the need to continue to be careful, particularly in regard to "tipping points" for short-term spikes.
- One TAC member commented that the timeframes associated with the mercury studies were not clear and needed better definition (i.e., what is the difference between pre-notch, immediately after, and post-notch).
- One TAC member suggested modifying the scope of the mercury study question since as it is written, the scope seems very large.
- One TAC member commented that "meeting or not meeting expectations" is not the right wording in the case of mercury. Expecting a horrible outcome and then causing it anyway should not be given a green light, but that is what the wording implies. Others agreed that the mercury spike was expected but potentially bad.

Discussion and Comments on the Stoplight Chart

- Why is there no stoplight score for steelhead under the topic of fish and water quality?

    - John Bourgeois: We have very little data. We did a small study in collaboration with the Santa Clara Valley Water District, NOAA, CDFW and UC Davis tagging fish in Guadalupe Creek. There is some upstream data, but we do not know about other areas. We can add a footnote about minimal data for that question.
    - Follow up comment: Consider rephrasing the Key Uncertainty question to be about habitat and conditions, since the baseline population numbers are unknown. This species is not very useful as an indicator.
- Are the algal blooms coming in from adjacent land uses necessarily a bad thing? Maybe it comes down to the language used (i.e., what are the expectations, targets, goals, etc.)
    - John Bourgeois: There might be some value to the algal blooms, but algae is a big dissolved oxygen management issue for the Project. There are ponds where we had models and a management plan, but things turned out differently. We found that we could not manage some areas as effectively as we thought we would be able to.
- The stoplight colors work well for communicating to the public.
- Make sure the visuals are consistent (i.e., the location of the colors).
- It needs to be clear that the "trigger" is for management (i.e. for the PMT to take corrective action).
- Reconsider the language used for each color:
    - For the red and dark green colors, consider removing "Meeting/Not meeting expectations" and replacing with "Negatively/positively impacting."
    - The dark green example (western snowy plover data) shows a positive trend. The light green and orange categories currently termed "Trending positive/negative" could be replaced by "Uncertain but likely moving positive/negative."
    - There is some confusion in the current stoplight categories regarding the level of impact (positive/negative) in relation to the level of uncertainty (high/low), and also by how much is actually caused by the Project.
- The tendency to put "grades" or "scores" on these outcomes is not necessarily the best scientific approach. The results should be put more in terms of management outcomes and informing management decisions. Instead of a grade or color, consider listing what the management implications are (e.g., for birds, discuss overall breeding, shells and gravel improvements, and actions that can be taken to continue to improve breeding grounds.) This may be challenging to communicate, but will be more accurate. The science will always be dynamic and changing, but there are implications for planning and restoration actions. The grading approach may result in the Project taking ownership of issues that are not within its scope (e.g. gulls).
- Consider developing stoplights at different timescales to provide a snapshot on how the science and conditions are changing over time (e.g., short-term/10 yrs.; Phase 2 intermediate targets; long-term/50 yrs.).
- Consider finding a way to factor in the shifting baselines.
- Consider using trajectories or scenarios to help visualize the timeline of Project progress.
    - John Bourgeois: Drawing trajectories could give the impression of certainty that we do not have. However, maybe the dots would all be yellow, which might be ok.
    - Follow up comment: If everything is yellow (uncertain), then the question might shift.
- Consider presenting the external processes of change that impact the Project especially long-term—e.g. SLR, land use change.
- John Bourgeois commented that one potential adaptive management action is changing the goal, which should be more explicit in the approach.

Phase 1: Lessons Learned

- Organizing the science summary by topic works well.
- Consider rephrasing the Key Uncertainties questions for clarity when communicating with the public about Project progress.
- Consider a broader lens for Phase 2 science (e.g., landscape scale dynamics, bigger trends that will affect the Project).
- Think about the restoration of physical and ecological processes rather than target endpoints.
- Be clear about Project-relevant baselines and key drivers.
- Given the external forces on the Project (e.g. SLR), one approach might be to envision alternative endpoints or alternative targets given certain changes.
- If there is a regional avian issue impacting other projects in the Bay with similar results and effects, there might be value in tying together the studies.
- In the area of water quality, the current approach seems to be about not making things worse. However, it is also important to consider a more positive view of what the ponds can do. Consider including this perspective in the overall view of what drives management decisions.
- There is a need to clarify next steps from the PMT. Moving forward into Phase 2, be clear about the decisions that are going to be made and how the stoplight will be used to impact management decisions.
- One of the Key Uncertainties questions concerns reference marshes. The PMT needs to track how mature marshes are doing relative to restored marshes. Mature marshes are also threatened. One idea is to fund a regional program to collect baseline data on marshes throughout the Bay. (Note: USFWS is working on mature marsh study outside the Project.)
- In prioritizing Project funding it is important to consider the prospects for success of management actions. Some areas of concern from the stoplight assessment might be impractical to address.

Proposed Phase 2 Science Approach

John Bourgeois reviewed key issues that inform the proposed science approach in Phase 2 of the Project. SLR projections have changed (increased) in the last several years, and Phase 2 restoration actions will likely be racing against SLR. There are ongoing challenges in balancing the changes for pond species and marsh species as the Project moves toward the 50:50 tidal marsh to ponds ratio in Phase 2. The approach to Phase 2 is influenced by the Baylands Ecosystem Habitat Goals Update 2015 report, which emphasizes restoring complete processes and systems, restoring soon, and planning for the migration of the Baylands.

There are four projects in the Refuge that are currently going through the permitting process. The PMT hopes to start construction in 2018. Proposed Phase 2 projects at Eden Landing and the Shoreline Study will follow the four projects. He reviewed the current Phase 2 alternatives and showed maps and designs for each construction project (see Appendix A for more detailed design descriptions).

He showed several Project maps illustrating Phase 1 restoration areas to date and planned expansion areas in Phase 2. If the most fully tidal marsh alternative is selected for Eden Landing, the result of all Phase 2 construction would be to reach 56% tidal restoration in about 10-15 years.

Phase 2 Proposed Science Approach

Ariel Ambruster explained that the PMT developed a list of priority topics for Phase 2 science to focus on. Project managers significantly revised the approach to Phase 2 science, based on feedback that the PIs gave in March 2017. This revised document was provided to TAC members in advance of the meeting.

One PI, Mark Marvin-DiPasquale of USGS, provided an overview of the science strategy that PIs suggested for Phase 2, which emphasizes a more integrative approach.

- He emphasized putting the vision ahead of resource constraints.
- Phase 1 science included many great studies and was marked by moderately good coordination of efforts and integration of results. The mercury working group is a good example of coordination to answer common questions. However, Phase 1 science primarily included discrete studies.
- One integrative approach might be to develop conceptual models and better sampling linkages to tie together data collection. There is a need to improve the sampling efforts and data sharing. He asked TAC members to consider how to make the Phase 2 Science Plan more integrated, efficient, and cross-topical, and shift in focus to integrated studies and better conceptual linkages between "Issues of Concern" (e.g., bird habitat use, mercury bioaccumulations, and water quality).
- Phase 2 science should leverage the powerful remote sensing technology that exists. There are ways to collect more information with monitoring technologies. He recommended coordinating sampling efforts, satellite/aerial and ground-truthing.
- Central organizing themes might be helpful to coordinate the science (e.g. habitat type and evolution, avian/food web studies, invasive species, mercury and water quality, sediment dynamics).
- Another integrated approach would be to identify common study "sandboxes" (e.g., organize science questions around the next A6-type breach).
- Remote sensing technologies can produce powerful views of the system (e.g. rating curve comparing dissolved organic carbon and filter-passing methyl mercury).
- There are several practical actions the PMT could take in Phase 2 to move the integrated approach forward:
    - Develop a remote sensing working group (even if only temporary) to educate PIs and stakeholders about various platforms that could provide data.
        - Identify all the metrics that are available.
        - Discuss which platforms optimize info sharing.
    - Develop/improve system for information sharing and coordinated data collection.
        - Develop common e-space for SBSPR Project research and stakeholder community.
        - Share basic field sample information.
        - Focus on strengthening linkages, and resources.

John Bourgeois explained that Phase 1 was an RFP process, with discrete studies answering discrete questions, which is how the "compartmentalization" Dr. DiPasquale just discussed. In Phase 2, in an effort to shift away from silos and instead use emerging technologies, one of the goals for the Phase 2 science program is to increase the number of integrated studies over time, and decrease the number of discrete studies. The PMT wants to tap into regional monitoring and try to avoid situations where entities in the region are all competing for the same resources for similar projects, and engage in "methodology development" as a way to keep improving future science efforts.

He reviewed the list of proposed studies for Phase 2. The timeframe for Phase 2 is 10 to 15 years. The PMT identified bird use of changing habitats as a priority because of the ecological trade-offs associated with the changes. There are major uncertainties associated with SLR, sediment availability, and mudflat habitats. Nuisance species include gulls, *Spartina alterniflora* and its hybrids, predator management issues, etc. The PMT also identified sediment dynamics as a priority topic for the integrated studies. For integrated bird use studies, there is the potential to use new technology for surveys. The PMT prioritized topics that lend themselves to a regional and/or integrated approach, and based decisions on the assumption that resources will be tight.

In response to several TAC member questions, John Bourgeois clarified the following issues:

- Regarding the absence of fish on the list of proposed studies, all the data the PMT has indicate that restoring to tidal marsh positively impacts fish. In the context of limited resources, this topic was not included in Phase 2 studies. Phase 1 did include a fisheries working group, which disbanded itself for lack of need. Since more breaches are planned in the future, the focus of the science is more on which species stand to lose habitat.
- Regarding flood protection, the Project is legally obligated to maintain the current flood protection levels. Chris Barr of the USFWS San Francisco Bay Wildlife Refuge Complex commented on the importance of Phase 2 projects moving forward particularly because they address baseline flood protection. The region struggles to get enough resources to address deferred levee maintenance and can only work with what Congress appropriates.
- Regarding potential structural instability of the 30:1 slope ratio for proposed habitat transition zones, he explained that the a 10:1 slope constructed by the SCVWD in Pond A8S has been remarkably stable compared to the adjacent levees subject to the same wind-wave energy (unpublished work performed by ESA for the Project). In terms of SLR, a slope with a ratio of 30:1 would allow time for the PMT to take corrective action if necessary.

He asked for TAC members to provide feedback on the proposed Phase 2 science approach.

Discussion and Comments on the Phase 2 Overall Approach

- The sandbox approach is a good way to bring together the key questions and answer larger questions, to move the science forward.
- The PMT should frame the Key Uncertainty questions from the perspective of climate change impacts and landscape level processes.
- Phase 1 science focused on parameters at a particular site (e.g. a pond). In Phase 2 there are opportunities to think about parameters and dynamics at a larger scale, including how things are moving in, out of, and through the system. For example, the water quality system is larger than one pond, and might benefit from a landscape level approach.
- Discrete studies are different from monitoring to assess the Project progress. Project monitoring is important and should be a central element.
- The way monitoring is built into the studies is confusing. Monitoring is different and not in and of itself addressing uncertainties. Scientists can make use of monitoring studies to explore uncertainties.
- There are some types of monitoring that that do not need to be done constantly and instead can be done intermittently once the systems are well-calibrated.

- Discrete studies should be done in the context of integrated studies (i.e. nested within the integrated studies).
- There is a need to more clearly define what "integrated" means in the context of Phase 2 science.
    - Integrative should mean interdisciplinary.
    - Integrative does have to necessarily mean directly integrating studies, but sharing lessons learned Bay-wide.
    - Integration can start at the landscape level and address larger ecological processes (i.e. integrate from the top down rather than bottom up).
- There are requirements for regulatory monitoring, but there is a general need for monitoring overall. Make a distinction between monitoring that is required as part of a permitting process and monitoring that is more about how the system is working or that is otherwise part of some project-driven question. That distinction can help set up the framework for the integration of data and studies or monitoring because some monitoring must happen, so you can start looking for efficiencies in collecting and sharing that data and then start building in those other pieces.
- Observations are needed to know where you are going, or to identify lessons learned for future designs. With the scope of potential future changes and resource issues, the PMT needs to know what the data are for and create a goal/plan for what to do with the data. There are new technologies, new ways of gathering data that are efficient and economical, and there is benefit to thinking regionally.
    - John Bourgeois: Not all monitoring is created equal from the perspective of which monitoring data are critical for decision-making. In addition, some data will become increasingly difficult to obtain given the physical landscape changes.
- In the proposed science approach documents there is more detail in the discrete studies than in the integrated. The two categories could be combined.

Discussion and Comments on Priorities for Discrete and Integrated Studies

- Continue large scale habitat evolution mapping.
- Consider what information would be useful to know in 50 years and use that framework as a lens for discussion of science priorities.
- In the area of invasive species, it is clear that gulls and ravens are a problem and will be a bigger problem in the future. The PMT should focus resources on management effort, control, and effectiveness rather than studies on landfill use.
- There is a need to think about how uncertainties are framed (e.g., is there enough sediment, and is there enough to accrete by the desired timeframe).
- For some parameters, the expectation/hope is to understand the variability enough to not need to sample with as much frequency.
- The Key Uncertainty questions are vague. What defines an unacceptable impact to an existing habitat? For what and which species?
    - John Bourgeois: The general approach is to look at reductions in the quantity of mudflat needed to restore the marshes, and identify where the tipping point is. However, the PMT does not have a really good answer at this point. There are challenges in identifying the thresholds. This is made more complicated by difficulties in accurately mapping the mudflats.

- In the Netherlands people are increasing the height of levees to combat SLR. The Project has primarily focused on removing levees. How does Phase 2 address increasing the height of certain levees? There are no applied studies of levees or levee testing.
    - John Bourgeois: None of the breaches in Phase 1 increased the flood risk. In Phase 2 we will have to look at significant flood control issues. The modeling we have done indicates we can achieve adequate marsh plain elevation by 2030. Moving forward into the future, we might need to look at it more carefully. Every county handles flood control a little differently. The PMT considered the levee issues more as design topics, not science topics, but we could reexamine that. The Water Board has asked the Project to update the adaptive management plan to include the upland transition zones.
    - Follow up comments: The South San Francisco Bay Shoreline Study undertaken by the USACE, Santa Clara Valley Water District and State Coastal Conservancy will be expanding geographically. Coordination is also occurring with other flood control efforts such as the SAFER Bay project (San Francisquito Creek Joint Powers Authority).
- Fish are not as visible and as such are often overlooked. Channel evolution and channel changes will affect fish and other species, and remote sensing might be able to capture some of that data. Mercury analysis might need to include continued analysis of sentinel fish species.
- One example of integration would be a mercury study that would address water quality, key species, and bathymetry.
- One example of integration without performing additional studies is to have a fish biologist analyze water quality data for implications to fish species. This could bring in the "fish perspective."

Discussion and Comments on Executing the Approach

- At the outset, PIs and the PMT should convene to share information, integrate projects, and identify what kind of data are needed across the board. Additional data are needed for all the uncertainties (e.g. data needed for transitional habitats). The science approach should address permitting needs and data uncertainties.
    - John Bourgeois: The integrative approach could be built into the RFP process, like a first cut to bring together conceptual models.
- Coordinate with the North Bay to look at things at a regional scale.
- Scenario planning could be a way to integrate the data and knowledge.
- Use working groups as a way to integrate the science.
    - John Bourgeois: Working groups have been put on hold with the departure of Laura. If we move to a more integrated approach, we could expand the working group process. Working groups require commitment, which can be challenging without the right leadership.
- Explore interest among tech companies in the Bay to engage and provide support.
    - John Bourgeois summarized his previous efforts and the relative lack of fruitful outcomes in several years on that effort.
- Consider using the State of the Estuary conference as a platform or venue for collaboration.
- There is a question about whether field time is the main barrier to integration. The PIs and PMT should assess how often topics overlap.
    - Follow-on comment: In the North Bay, actual field monitoring takes a lot of time and effort. As ponds accrete, we cannot get the same number of data points for longitudinal studies.

- Investment in a coordinator is key (e.g., the California Landscape Conservation Cooperative funds a coordinator position for studies across the valley).
- Addressing shared data needs and a data sharing platform is potentially low-hanging fruit. Data collection is ongoing and does not require people to agree on a joint project.
    - John Bourgeois: A database will require maintenance. Is that the Project's burden, or could that be a regional investment?
- Consider if there is a role for citizen science/monitoring. There are existing examples in other places such as the Central Coast. The data will be more qualitative, but could be useful.
    - John Bourgeois: Citizen science has happened on the Project but is challenging.
    - Cheryl Strong: SFBBO has done citizen science projects. Bird monitoring can be successful and water quality also is a good area.

Discussion and Comments on Existing Models, Information, and Lessons Learned

- The NERR program out of NOAA might be a useful model. The sentinel site program is in place in Reserves around the country. The concept is similar to the sandbox idea. In the SF Bay NERR, the goal is to collect very accurate data on marsh accretion to understand SLR.
- Look at how the USGS Innovation Center partnered with NASA-AMES to develop innovative technology approaches.
- The Sears Point restoration project in the North Bay had interesting marsh panne design components. They are tracking vegetation recruitment in the marsh pannes, which provide very diverse habitat and windbreaks.
    - John Bourgeois: The PMT experimented with marsh panne features at Eden Landing. However, vector control districts are opposed to those features. We have not given up the idea, but we have to be strategic.
- The Sonoma Baylands project is going to end its 20 to 30 years of monitoring. The reports include lots of very useful data. The PMT can look at those reports and think about how to do things differently. In that project, as vegetation increased, they documented fewer fish, but many more rails, indicating that the wildlife will follow the vegetation and sedimentation.
- When deciding on which projects to move forward with in Phase 2, the PMT needs to consider if projects are feasible to construct. Construction in current conditions can be a challenge and will likely become increasingly challenging in the future.
- In the North Bay, Cargill and Ducks Unlimited have been incredibly valuable partners, and the earlier they come into the design process the better. We learned a lesson about investing in survey work to save money in dirt moving costs.
- The PMT should continue to take advantage of opportunities to secure resources from unexpected sources (e.g. free dirt for Bair Island).

Summary, Action Items, Next Steps

Ariel Ambruster reviewed key recommendations and insights from the TAC, including the importance of updating the previous estimates of SLR and framing Key Uncertainties in this new context and developing clear and consistent ways the stoplight and the other metrics describe the outcomes (good v bad; increase v decrease; better or worse than expected; and so on). TAC members also shared great ideas for ways to integrate the different questions and uncertainties into "concepts."

John Bourgeois explained the PMT will consider TAC members' input and revise materials given the feedback received, and will follow up with people individually as needed. A summary of the TAC meeting will be made available. Ultimately, the PMT wants to develop an RFP for Phase 2 studies. He

encouraged TAC members to continue to submit comments by email or get in touch by phone. He reminded participants that Lynne Trulio is the interim lead scientist and that Dave Halsing is currently acting as the deputy Project manager. In closing, he thanked participants for their input.

Attachment 1: August 1, 2017 Meeting Attendance

Note: Current TAC members are starred (*).

Name	Organization/Affiliation
Howard Shellhammer*	Mammologist
Ryan Mayfield*	City of San Jose
Jeremy Lowe*	SFEI
Jana Sokale*	JSEP
Michael Vasey*	SF Bay NERR
Tom Gandesbery*	SCC
John Takekawa*	Audubon California
Steve Rottenborn*	HT Harvey
Pat Mapelli*	Cargill
Rusty Holleman*	SFEI
Michael MacWilliams*	Anchor QEA
Francesca Demgen*	Biologist
Mark Stacey*	UC Berkeley
Clayton Leal*	SCVWD
Lisa Porcella*	SCVWD
Donna Ball*	Save The Bay
Susanne von Rosenberg (by phone)*	Gaia Consulting
Kim Squires (by phone)	USFWS
Ariel Ambruster	SBSPR Facilitation Team
Kristin Byrd	USGS
Katherine Sun	USFWS
John Bourgeois	SCC, SBSPR Executive Project Manager
Brenda Buxton	SCC
Dave Halsing	ESA
Matt Gerhart	SCC
Alex Cole-Weiss	SBSPR Facilitation Team
John Krause	CDFW
Mark Marvin-DiPasquale (by phone)	USGS
Stacy Moskal	USGS
Cheryl Strong	USFWS
Rachel Tertes	USFWS
Karine Tokatlian	SFBBO
Chris Barr	USFWS
Errol Gabrielsen	SCVWD
Josh Ackerman (by phone)	USGS
Judy Nam	SCVWD
Laura Cholodenko	SCC
Lynne Trulio	SJSU
John Tirpak	USFW-SFBNWRC

Lisa Owens	Landscape Architecture Magazine
Kristen Struve	SCVWD
Colin Grant	USFWS

Appendix A: Phase 2 Design Alternatives

- **Island Ponds Preferred Alternative**. Actions in Initial Stewardship Plan have resulted in ponds A19/20/21 filling in from the bayside areas first. In Phase 2 the plan is to add breaches on the Mud Slough side of A19 and lower the levees between A19 and A20 but leave high tide refugia zones.
- **A8 Complex Preferred Alternative.** In Phase 2, the intent is to create large habitat transition zones on the southern corners which will add habitat complexity, protect and buffer the landfill and provide a foundation for future tidal marsh restoration at this location. The design leaves a gap between habitat zones to try and reconnect the adjacent creeks (e.g. San Tomas Aquino Creek) with the Bay at a later date.
- **Mountain View Ponds Preferred Alternative.** Currently, A1 and A2W are ambient Bay salinity type ponds (3-4 feet deep with pond bottoms at 0 feet elevation). The intent in Phase 2 is to turn both ponds fully tidal. However, the Project needs to build a flood protection levee along the Coast Casey Forebay and make other improvements to the west levee of Pond A1. Other City of Mountain View projects are happening adjacent to the new Project levee. Also, the plan is to create large habitat transition zones protecting landfill areas and large linear habitat islands for short-term and long-term benefit. The design also includes a short new spur trail to an observation platform, a separate viewing platform in Shoreline Park, and another trail and viewing area combination on the eastern levee of Pond A2W. Since PG&E needs to maintain vehicular access along that outer levee, it needs to be retained. It will be breached and bridged to allow PG&E and public access. The plan is to look at the impacts of this new public access on wildlife.
- **Ravenswood Ponds Preferred Alternative.** This pond complex is right next to old landfills that are currently city parks. The plan is to restore pond R4 to a tidal marsh, take down outer levees, and reinforce inner levees. The design includes large upland transition zones along the landfill/park and levee. R3, a snowy plover pond, will largely stay the same, with additional water control structures for water level and water quality control as a way to enhance its habitat value. Ponds R5 & S5 will remain muted tidal, but with deeper water and more direct operational control over water levels and quality. The plan is to connect the existing Bay Trail to a trail inside the park and making a loop trail around these two ponds. This would concentrate public access near the highway and where the bird species that would use these ponds are already habituated to noise and human activity.