South Bay Salt Ponds Charette

A National Science Panel Report
February 27-28, 2005

National Science Panel

Dr. Denise Reed, Chair. Professor, Department of Geology and Geophysics, University of New Orleans.

Dr. R. Michael Erwin. Wildlife Biologist with the US Geological Survey's Patuxent Wildlife Research Center, Laurel MD and Research Professor in Environmental Sciences at the University of Virginia, Charlottesville, Virginia

Dr. Jorg Imberger. Professor of Environmental Engineering at the University of Western Australia

Dr. Samuel N. Luoma. Senior Research Hydrologist with the US Geological Survey

Dr. Jerry Schubel. President and CEO of the Aquarium of the Pacific.

Prof. Charles A. ("Si) Simenstad. Research Associate Professor at the University of Washington's School of Aquatic and Fishery Sciences

Dr. John Teal. Scientist Emeritus, Woods Hole Oceanographic Institution

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Acknowledgements

The National Science Panel would like to acknowledge all those who participated in the charette, most of whom did so on their own time, gave up a valuable weekend, and contributed enthusiastically to the outcome. The success of the charette relied on the broad range of local knowledge and scientific expertise contributed by each individual. We would especially like to thank our invited speakers (Jim Cloern, Shirley Laska, Rob Butler, Mary Scoonover, Steve Ritchie, Jeff Koseff, Jorg Imberger, and Maggi Kelly), the participants who agreed to take on the roles of provocateurs, rapporteurs, and team leaders (Mike Connor, Dilip Trivedi, Lou Armstrong, Amy Hutzel, Letitia Grenier, Carl Wilcox, Dave Schoellhamer, Si Simenstad, Susan Peterson, John Krause, Beth Dyer, and Lynne Trulio), the team of facilitators from the Center for Collaborative Policy (Mary Selkirk, Austin McInerny, and Greg Bourne), and the charette organizer (Lisa Hunt). The California Coastal Conservancy provided funding for the charette.

EXECUTIVE SUMMARY

The State of California, the Federal Government, and their partners have embarked on the restoration of 15,100 acres of Cargill's salt ponds in South San Francisco Bay. Acquisition of the South Bay salt ponds provides an opportunity for landscape-level wetlands restoration, improving the physical, chemical, and biological health of San Francisco Bay. The South Bay Salt Pond Restoration Project (SBSPRB) will integrate restoration with flood management, while also providing for public access, wildlife-oriented recreation, and education opportunities.

The SBSPRP's National Science Panel spearheaded the concept of a design charette to lay out a long-term vision that can guide the project over several decades, and bring existing experience to bear on both the identification of important research issues and opportunities for early restoration successes.

The goals of the charette were to:

> **Goal 1**. Create a landscape map of the nearshore environments of the South San Francisco Bay salt pond area that captures the goals and objectives of the Restoration Project (Exhibit A), and that participants feel could be achieved and sustained in 2050 given the existing understanding of the processes that will control the formation and maintenance of nearshore habitats at that time.
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> **Goal 2.** Identify the most important and uncertain issues, processes, and phenomena that will control the formation and maintenance of nearshore environments in 2050 and formulate specific research questions.
>
> **Goal 3.** Identify several specific locations that could be used for early restoration projects to demonstrate success and garner public support.

To stimulate the charette participants and inspire them towards the goals, presenters for the opening session were asked to focus on the future and provide insights into how they felt conditions and processes in the future might differ from those of today and how those differences might affect achieving and sustaining the desired end state.

The program subsequent to the plenary session was centered around the three charette goals:

Goal 1. The Landscape Vision for 2050

The basic strategy was to form three "vision teams" each with expertise and experience in all the appropriate fields, to give each of the teams the same assignment, and then to search for recurrent patterns and differences in their responses. Each of the three vision teams developed a slightly different map for the landscape in 2050. Further collective consideration of the vision team products by representatives of each team led to general consensus across all teams. However, the group was unable to converge on a single map, and ended up with two versions of a desired and achievable future. In spite of the differences, the agreement for much of the South Bay area was reassuringly high. Differences are a result of some of the uncertainties regarding important processes, driving forces, and ecological outcomes. The primary areas of disagreement are in the extent of managed ponds in the Eden Landing and Alviso areas and arise for several reasons. The viability and suitability of tidal marsh pannes as habitat for migratory birds, including the western snowy plover and California least tern, have yet to be established. If pannes can provide foraging and breeding habitat to support these and other migratory birds, tidal habitats will be preferred. In the Alviso area, an additional critical uncertainty is mercury. Consensus was strong that if mercury methylation is not a significant risk, tidal marsh is the preferred habitat. If mercury methylation is a significant risk, managed ponds are the preferred habitat.

Goal 2. Important Uncertainties

Each team also identified issues surrounding the achievement of their respective visions that were both important and uncertain. The groups came to a consensus on the most important and uncertain driving forces and processes on which to focus research, five of which were selected for further discussion.

Sediments

Consensus was that enough sediment exists to create tidal marsh, but the rate of sedimentation is uncertain, and it is not known whether creation of tidal marshes would result in the erosion of mudflats, and to what extent. However, it may be possible to encourage marsh or mudflat restoration or growth in some areas to compensate for loss elsewhere.

Much discussion focused on whether mudflats would be eroded in the creation of salt marsh and, if so, what would the ecological consequences be. The magnitude of this effect and the rate of sedimentation will depend on sediment management activities in watersheds and the phasing, locations, and size of restoration projects. Pollutants buried in sediments also need to be considered.

Ecological Trade-offs

Consensus indicated that it is important to predict functional shifts as well as population shifts, at local to regional scales, and to consider the organization of the landscape in terms of how much, where, and when. Relationships between functionality and habitat area must be further explored in a landscape ecology context.

Global-Regional Interactions

Important global and regional interactions to consider in project planning include effects of sea-level rise, long-term changes in sediment load to the Bay, effects of extreme meteorological events to both the Bay and the project domain, effects of changes in the project domain on migratory birds in the Pacific Flyway, human expectations and public support, and far-field changes in California water operations.

Mercury

The risk of mercury methylation is considered greater in tidal marshes than in managed ponds. Thus, it is important to identify the importance of the mercury issue and design the restoration incorporating this factor. The mercury group's discussion focused on trying to reduce uncertainty in the very short term. Longer-term mercury questions (e.g., 10 and 20 years) should be addressed in context of bigger programs.

Ponds and Pannes

Data from early actions and studies should generate more information on whether pannes and ponds are likely to form naturally in restored marshes, or whether they can and should be engineered. It would be useful to collect data on the ecological and habitat functions of mad-made pannes and ponds versus natural ones.

Goal 3. Target Areas for Early Action

To achieve the SBSPRP goals in the face of scientific uncertainty, landscape complexity, and changing environmental conditions, adaptive management will be necessary, meaning that opportunities for early learning must be used as fully as possible. The group collectively identified a number of target areas for early restoration implementation, and smaller teams developed recommendations on how the project could take advantage of the opportunities presented by some of the target areas.

Two categories of early actions were identified:

- Actions that would be clearly visible to the public and have a high probability of success in achieving stated goals and objectives. Specific target areas discussed in detail were the ponds at Eden Landing between Old Alameda Creek and Alameda Creek flood control channel, and Ponds A8/A9.
- Opportunities to collect data as part of restoration actions that are already planned under the Initial Stewardship Plan. These actions included breaching levees on the Island Ponds to connect Coyote Creek (planned for March/April 2006), and breaching levees in the Eden Landing/North Creek/Old Alameda Creek area (planned for April 2005–November 2006).

The group also noted that other current projects (not related to the SBSPRP) such as Bair Island and LaRiviere Marsh also provide opportunities for data collection.

INTRODUCTION AND BACKGROUND

The State of California, the Federal Government, and their partners have embarked on the restoration of 15,100 acres of Cargill's salt ponds in South San Francisco Bay. Acquisition of the South Bay salt ponds provides an opportunity for landscape-level wetlands restoration, improving the physical, chemical, and biological health of San Francisco Bay. The loss of approximately 85 to 90 percent of the tidal marsh in the Bay has led to dramatic losses of fish and wildlife in tidal marsh habitat, decreased water quality, and increased turbidity. The South Bay Salt Pond Restoration Project (SBSPRB) will integrate restoration with flood management, while also providing for public access, wildlife-oriented recreation, and education opportunities. The Mission, Goal, Guiding Principles, and Objectives of the project are listed in Appendix A and are summarized in Exhibit A. More detailed information is available at www.southbayrestoration.org.

Exhibit A

SOUTH BAY SALT POND LONG-TERM RESTORATION PROJECT
MISSION, GOAL & OBJECTIVES
February 19, 2004

Mission: To prepare a scientifically sound and publicly supported restoration and public access plan that can begin to be implemented within 5 years.

Goal: The overarching goal of the Long-Term Restoration Plan is the restoration and enhancement of wetlands in South San Francisco Bay while providing for flood management and wildlife-oriented public access and recreation.

Objectives:

1. Create, restore, or enhance habitats of sufficient size, function, and appropriate structure to:
   - Promote restoration of native special-status plants and animals that depend on South San Francisco Bay habitat for all or part of their life cycles.
   - Maintain current migratory bird species that utilize existing salt ponds and associated structures such as levees.
   - Support increased abundance and diversity of native species in various South San Francisco Bay aquatic and terrestrial ecosystem components, including plants, invertebrates, fish, mammals, birds, reptiles, and amphibians.
2. Maintain or improve existing levels of flood protection in the South Bay area.
3. Provide public access and recreational opportunities compatible with wildlife and habitat goals.
4. Protect or improve existing levels of water and sediment quality in the South Bay, and take into account ecological risks caused by restoration.
5. Implement design and management measures to maintain or improve current levels of vector management, control predation on special-status species, and manage the spread of nonnative invasive species.
6. Protect the services provided by existing infrastructure (e.g., powerlines, railroads).

Essential to successful planning of this restoration effort is the early and clear articulation of a landscape vision for the South Bay such that plans and strategies can be developed to achieve the comprehensive goal. To achieve this goal, the SBSPRP's National Science Panel (NSP) spearheaded the concept of a design charette to lay out a long-term vision that can guide the project over several decades, and bring existing experience to bear on both the identification of important research issues and opportunities for early restoration successes.

This report summarizes the results of the charette held at the Marconi Conference Center in Marshall, California, on February 27-28, 2005.

PURPOSE OF CHARETTE

The NSP felt that given the extensive research that has been conducted in South San Francisco Bay over many decades and the richness of experience and expertise of the Bay Area scientific community, it was essential to provide an opportunity to efficiently mine this existing data, information, and expertise. In addition, the NSP believed it important that the project explicitly identify restoration opportunities and constraints in a spatially specific manner and embrace an expanded view of the South San Francisco Bay ecosystem, above and beyond the salt ponds presently owned and targeted for restoration. Concepts of landscape ecology can be useful in understanding and incorporating landscape elements and structure to optimize the desired outcome of the overall project. Consequently, the charette was planned to accomplish three goals:

> **Goal 1**. Create a landscape map of the nearshore environments of the South San Francisco Bay salt pond area that captures the goals and objectives of the Restoration Project (Exhibit A), and that participants feel could be achieved and sustained in 2050 given the existing understanding of the processes that will control the formation and maintenance of nearshore habitats at that time.
>
> **Goal 2.** Identify the most important and uncertain issues, processes, and phenomena that will control the formation and maintenance of nearshore environments in 2050 and formulate specific research questions that are tractable and will significantly reduce the level of uncertainty if pursued, enhancing the likelihood of creating a desired nearshore landscape that is sustainable.
>
> **Goal 3.** Identify several specific locations that could be used for early restoration projects to demonstrate success and garner public support.

A key element in the charette strategy was to engage some of the best minds with the greatest experience and expertise on South San Francisco Bay to work together as interdisciplinary teams to frame the design challenges in the context of their areas of specialization, so that the complete and integrated set of these would represent the best current thinking. The underlying assumption was that by using acknowledged experts to exploit existing information, understanding, and knowledge of the South Bay system, specific research questions would emerge that would enable the Restoration Project to create, achieve, and sustain the ultimate design.

CHARETTE APPROACH

The charette strategy was developed by the NSP working with the Center for Collaborative Policy and Project staff. To stimulate the charette participants and inspire them towards the goals, we invited several scientific experts to make synthetic, plenary presentations in an opening session. The speakers and their topics are shown in the agenda (Appendix C). Each of the presenters was asked to focus on the future and provide insights into how they felt conditions and processes in the future might differ from those of today and how those differences might affect achieving and sustaining the desired end state.

The program subsequent to the plenary session was centered around the three goals:

> **Goal 1.** The basic strategy was to form three "vision teams" each with expertise and experience in all the appropriate fields, to give each of the teams the same assignment, and then to search for recurrent patterns and differences in their responses. Each team had an experienced facilitator, a rapporteur, a provocateur, and the same set of resource materials. The assignment to each team was to make their best effort to achieve the goals of the charette. The use of teams was adopted to keep the groups small enough to foster a lively exchange of ideas that would involve all participants, and to create a sense of competition among teams. The teams were formed by the organizers in advance of the charette, but participants did not know what team they were on until early in the opening session of the charette. Maps were provided to ensure that the visions were spatially specific and could be directly compared among teams.
>
> **Goal 2.** The vision teams were also asked to scale important issues constraining restoration, according to the level of importance and the level of uncertainty. Those issues that among the three teams emerged as both important and uncertain were discussed in self-selected teams. Each team was asked to clarify the important uncertainties and questions surrounding the issue and recommend research strategies to assist the restoration project.
>
> **Goal 3.** The group collectively identified a number of target areas for early restoration implementation, and assigned themselves to teams to develop the ideas further. Each of the teams was asked to provide recommendations on how the project could take advantage of the opportunities presented by the target areas.

The lead facilitator was Jerry Schubel. He was assisted by a team of facilitators from the Center for Collaborative Policy, by other members of the NSP, and several participants.

All attendees were provided with a copy of the project's Mission, Goal, Guiding Principles, and Objectives (Appendix A), as well as a copy of its Initial Opportunities and Constraints Summary (http://www.southbayrestoration.org/Documents.html). The complete roster of participants, facilitators, and observers is included in Appendix B, and the Agenda has been included in Appendix C.

RESULTS

This report summarizes the main results of the charette assembled from information provided by the plenary speakers, the systematic notes, and the flip-chart pages and summary overheads that were generated in each session. Discussion was wide-ranging but, for the most part, the information presented here represents a consensus of either the group (Goal 1) or the specialist teams (Goals 2 and 3).

Goal 1. The Landscape Vision for 2050

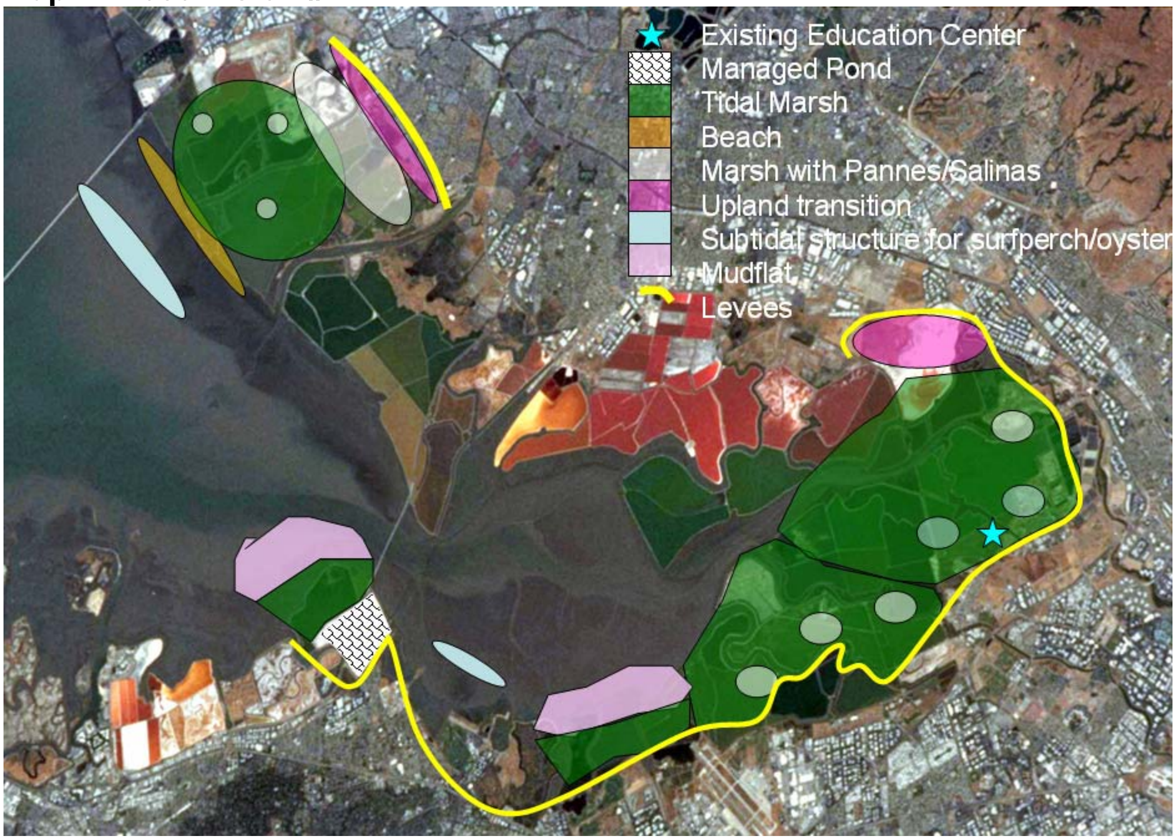
Each of the three vision teams developed a slightly different map for the landscape in 2050. The specifics of each team's work are summarized in Appendix D. Map 1 shows "existing conditions" that formed the starting point for each team's formulation of a "vision map."

Further collective consideration of the vision team products by representatives of each team led to general consensus across all teams. This consolidation exercise is described in Appendix E. However, the group was unable to converge on a single map, and ended up with two versions of a desired and achievable future. The two representations reflect differences in how the teams viewed the uncertainties and how those uncertainties would affect what was achievable and sustainable (see below). In spite of the differences, the agreement for much of the South Bay area was reassuringly high. Maps 2 and 3 show the two different representations of the charette's vision for 2050. These maps obviously are conceptual, and locations of various types of habitat are only approximate, but they provide useful insights into what charette participants thought probable futures for South San Francisco Bay's nearshore environments might be. These insights are not predictions.

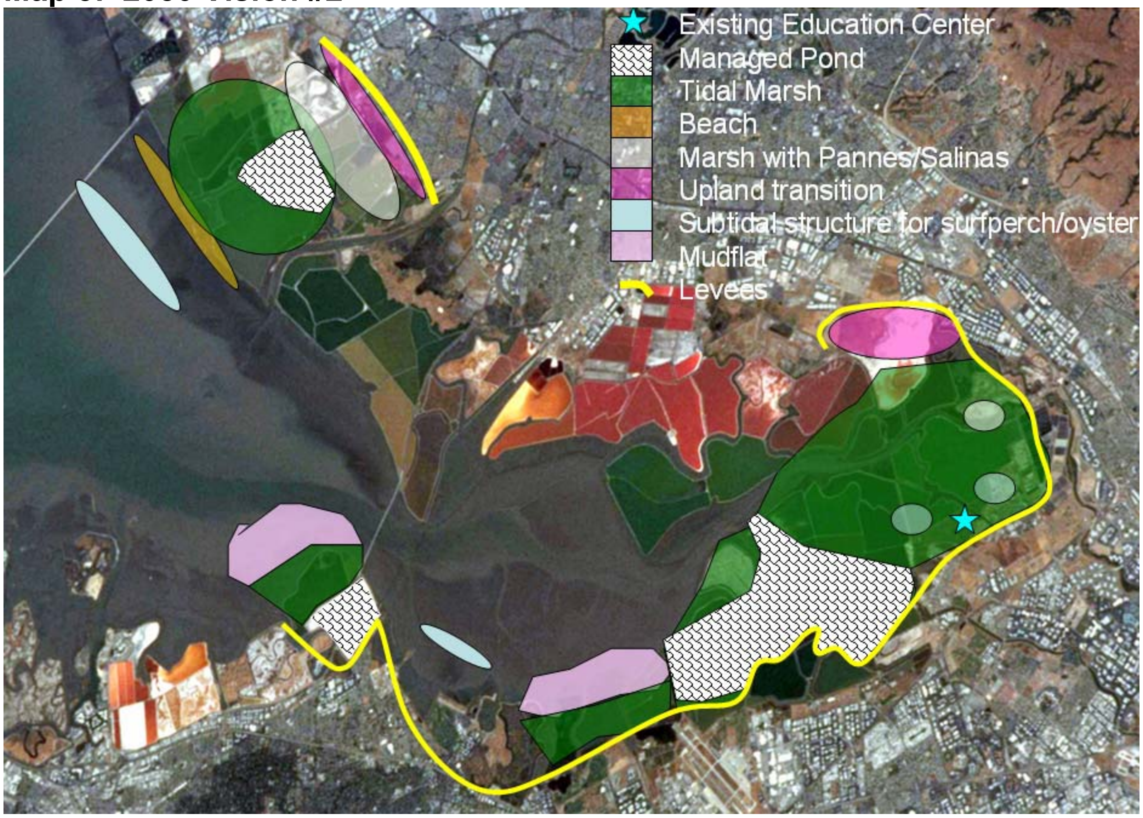
Differences between Maps 2 and 3 are a result of some of the uncertainties regarding important processes, driving forces, and ecological outcomes. The primary areas of disagreement are in the extent of managed ponds in the Eden Landing and Alviso areas for several reasons. The viability and suitability of tidal marsh pannes as habitat for migratory birds, including western snowy plover and the California least tern, have yet to be established. If pannes can provide foraging and breeding habitat to support these and other migratory birds, tidal habitats will be preferred. In the Alviso area, an additional critical uncertainty is mercury. Consensus was strong that if mercury methylation is not a significant risk, tidal marsh is the preferred habitat. If mercury methylation is a significant risk, managed ponds are the preferred habitat.

Map 1: Existing Conditions

Map 2: 2050 Vision #1



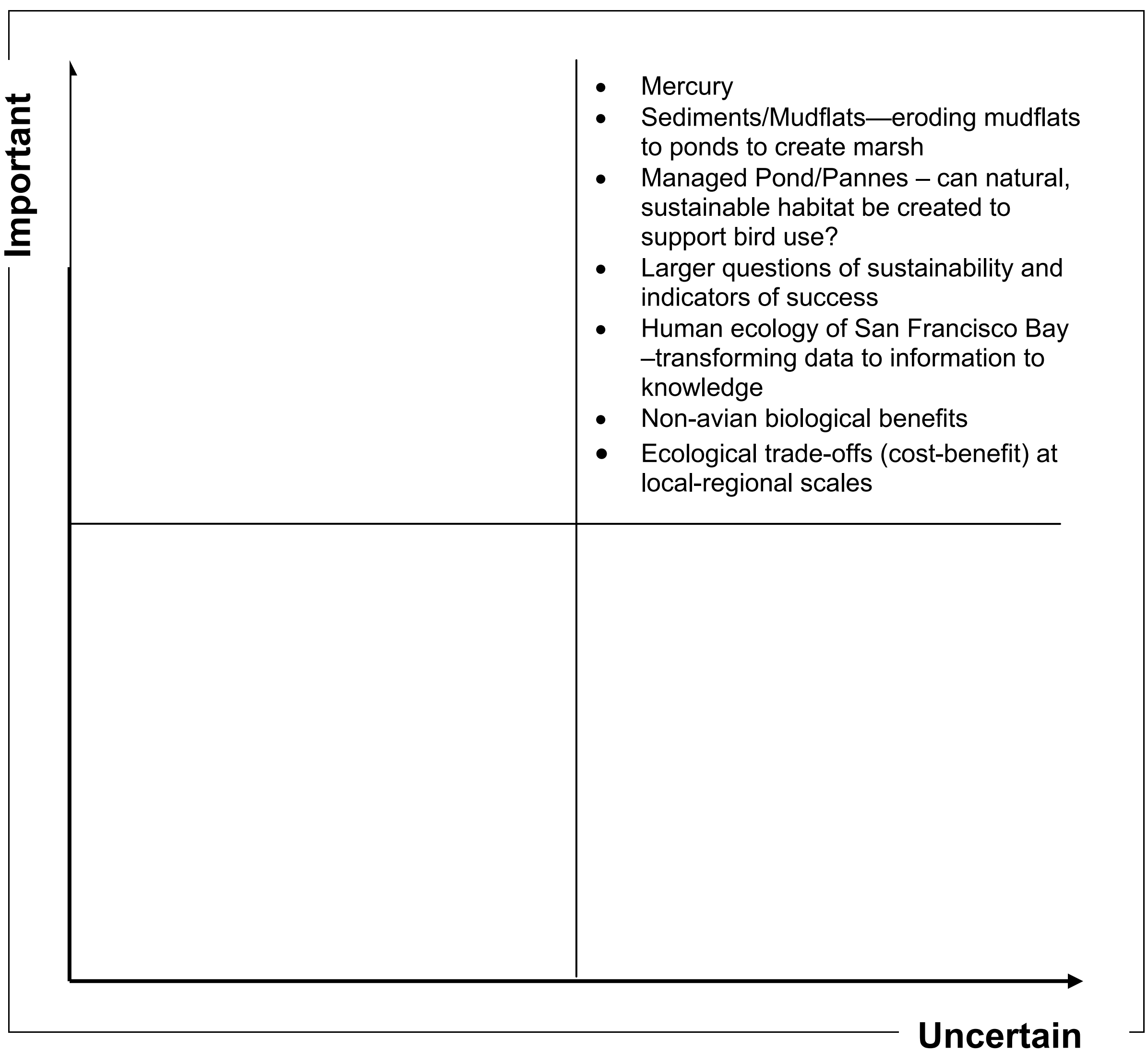
Map 3: 2050 Vision #2



Goal 2. Important Uncertainties

During the development of the visions, each team used an orthogonal grid approach and identified issues surrounding the achievement of their respective visions that were both important and uncertain. Appendix D shows the outcomes of each team's discussion. The group came to a consensus on the most important and uncertain driving forces and processes that the project should focus its research on to increase the probability of achieving the original restoration goals. The resulting grid is shown in Exhibit B. To further work in some areas five of these issues were selected by the group for additional consideration.

Exhibit B
Important Uncertainties



1. Sediments—Reported by Dave Schoellhamer

Consensus was general that enough sediment exists to create tidal marsh, but the rate of sedimentation is uncertain, and it is not known whether creation of tidal marshes would result in the erosion of mudflats, and to what extent. However, it may be possible to encourage marsh or mudflat restoration or growth in some areas to compensate for loss elsewhere.

Much discussion focused on whether mudflats would be eroded in the creation of salt marsh and, if so, what are the ecological consequences. The magnitude of this effect and the rate of sedimentation will depend on sediment management activities in watersheds and the phasing, locations, and size of restoration projects. Pollutants buried in sediments also need to be considered.

Important Issues/Questions

- Tidal flats represent the balance between sediment deposition and erosive forces; balance of those two creates mudflats. Will the balance on the adjacent tidal habitats change when marshes are created? It is believed that over time enough sediment will exist to create marshes, but what happens to mudflats?
- Will increasing tidal prism also contribute to loss of tidal flats?
- Tidal flats are used by many species (scoters, scaup, shorebirds, leopard sharks, bat rays, crabs, other fish identified in trawl surveys) – it is currently not known how much mudflat is needed to maintain viable populations of species. What species do mudflats support and at what density?
- What are the consequences of loss of mudflats? Does it matter if x amount of mudflats are lost? Are they limiting the ecosystem, or key species?
- Is sediment available for evolution of new tidal habitats? Over what time frame?

Recommendations

The group recommended that these key uncertainties needed to be addressed:

- Where will the sediment come from to create marshes?
- What is the rate of organic accretion after vegetation colonization?
- What pollutants are in sediment and what will be the effects on water quality of remobilization?
- What is the optimal use of dredge material, and how much is available and where?
- What are the sediment transport pathways that might bring material into/away from the restored area?

- What are the effects on primary productivity/spring bloom with changes in mixing?
- What will the effects of sediment mobilization be on shoreline erosion/protection?

These uncertainties could be addressed using either empirical geomorphic data or models relating erosive forces to sediment changes. Data from sediment-erosion tables or other monitoring techniques can be used with models to examine historical changes in mudflat evolution and project into the future. The alternative to this 'top-down' approach is using numerical hydrodynamic/sediment models calibrated using bathymetric changes to predict the future. Several existing tools (those of May, Lucas, others at US Geological Survey) could be used in this "bottom-up' approach. Data needs for these models include:

- Historical morphology changes (already available)
- Transport pathways for fine sediments
- Erodability of shallows
- Measurements of sediment accumulation/erosion across different bay habitats.

2. Ecological Trade-offs—Reported by Si Simenstad

Consensus indicated that it is important to predict functional shifts as well as, or even as an alternative to, population shifts, at local to regional scales, and to consider the organization of the landscape in terms of how much, where, and when.

Important Issues/Questions

- What happens if we can't control the *Spartina* hybrid? What would be the sequence of marsh flora and what would be the resulting functional response? Would at-risk species be affected?
- What is the carrying capacity of the system with current landscape interactions, and can capacity be increased by altering the landscape?
- What is known about site fidelity? Does it extend beyond a certain distance? Must the condition of systems elsewhere in the Bay, or even broader, region be considered?
- What will be the temporal trajectories of change in mudflats with/without restoration? How will benthic communities change or develop in the restored sites or newly accreted mudflats? What will be the implications to higher trophic levels that depend, directly or indirectly, on mudflat ecosystems?
- Can biota be attracted to new engineered salinas, seasonal wetlands, or sewage lagoons?

- How will the San Francisco Bay food web change? Will trade-offs occur between fish or mammals and birds? Or among bird species, e.g., rails vs. snowy plovers? How will less diatom production on mudflats and/or enhanced marsh detritus affect fish and birds?

Recommendations

- Some demonstrations or tests using experimental ponds or management of the upland transition could be used to address some of the uncertainties. All available existing data should be analyzed and modeling used as appropriate, e.g., to evaluate carrying capacity.
- Move away from the focus on the area of habitat to also examine functionality, e.g., look at complexes of habitats, linking them in different ways, the role of distribution, size, shape, connectivity in the landscape. Also, do relationships exist between functionality and the area of habitat? Identify responses of key species to the restoration landscape (complexity/connectivity), e.g., connecting a restoring marsh to an existing marsh, or incorporating an upland transition. Consider trade-offs associated with such aspects of the landscape, e.g., dispersal vs. access for predators.
- Evaluate site-specific functions (shorebird foraging, fish spawning) to identify mudflats that need to be sustained. How unique are mudflats as a source of food for higher trophic levels? How site-specific or food web pathway-specific are preferences/requirements?
- Examine differences in functionality across different complexes, as function of regional processes, to address the issue of how far can you extrapolate?
- Large-scale impacts analysis: model consequences of new invasives, climate change, etc., in terms of fitness and production.

3. Global-Regional Interactions—Reported by Jorg Imberger and Susan Peterson

Important Issues/Questions

- How will 0.5 meter of sea-level rise in 50 years impact on the subdomain of ponds?
- Will anticipated sediment load lead to increased loss of sediments?
- Will the anticipated meteorological extreme events change the equilibrium of the Bay? Of the domain?
- Will the proposed changes in the environment in the domain have an effect on migratory birds in the Pacific Flyway and vice versa?
- How are human expectations managed in habit restoration?
- How will far-field changes in California water operations influence project outcomes?

- How is consensus reached among conflicting regulations?
- How is public support built and sustained to maintain momentum of the restoration?
- What urban impacts have the most detrimental effects?
- What tools are available to anticipate the effects of catastrophic events in the outcome of the project?
- Will the changing climate change water column stratification and so lead to other larger-scale changes, e.g., in algal dynamics?

Recommendations

Due to time constraints, recommended approaches were developed only for these few identified important topics:

- Sea level

  Set up a 3-D physical and coupled ecological model and run the sea-level scenarios. Then, expose the results to an expert group (physical, ecological, human) that will also be asked to define the scenarios.

- Human expectations

  Generate a synthesis of existing literature and demographic data.

  Collect data from neighborhood groups and local businesses on current use of coastal areas, expectations for future use, and concerns associated with change (for example: reduced property values, changed traffic patterns, increased health risks, increased costs through fees or taxes).

  Use collected data to develop approaches to link the public segment to the project.

  Develop an interactive simulation capacity that will allow stakeholders to gain insight, input weightings, and test their own scenarios.

- Catastrophic events

  Explore the utility of existing predictive tools to assess the effect of catastrophic events.

  Explore the use of a real-time Index of Sustainable Functionality as an additional tool.

  Use the above tools in a gaming exercise.

4. Mercury—Reported by Letitia Grenier

The risk of mercury methylation is considered greater in tidal marshes than in managed ponds. Thus, it is important to figure out how important the mercury issue is and design the restoration incorporating this factor. The mercury group's discussion focused on trying to reduce uncertainty in the very short term. Longer-term mercury questions (e.g., 10 and 20 years) should be addressed in context of bigger programs.

Important Issues/Questions

- Does proximity to high mercury sources provide a significant increase in risk to people or fauna?
- Does the type of habitat created pose a significant increase in risk to people or fauna?
- Can the hydrology of existing and proposed ponds be managed to decrease risk?

Recommendations

- Identify food-chain linkages within the Bay and monitor mercury throughout the food-chain matrix using sentinel species specific to each habitat.
- Biota sampled for mercury should have a small home range, be habitat specific, and be sensitive to short-term change in methylmercury exposure.
- Locations for sampling should include the natural experiments at Eden Landing, and the Island Ponds, and the fringe marshes in Alviso Slough.
- Quantify and compare methylmercury in the biota of each habitat type: ponds, seasonal ponds/pannes, marsh plains, low marshes and small marsh channels, and mudflats.
- Conduct direct comparisons at the same time in different locations or before and after management actions to answer the three questions above. Use before-after-control-impact design to maximize study value.
- Tie in with other ongoing projects and overall important food-web questions.
- Monitoring design should recognize spatial gradients of mercury and salinity in the South Bay.
- Monitor baseline regional methylmercury levels in biota in the South Bay to assess regional effects, or coordinate this monitoring with the Regional Monitoring Program for Trace Substances.

5. Ponds and Pannes—Reported by John Krause

Important Issues/Questions

- Will pannes and ponds form naturally in restored marshes? How long will it take and where will they be?
- Can pannes and ponds be engineered? Will they be persistent? What material is necessary/available to create them?

- Will man-made pannes provide bird habitat and ecological functions of existing ponds? Will they cause mosquito problems?
- What are the effects of sea-level rise on ponds/pannes and marshplain generally?

Recommendations

- Synthesize existing data to determine if specific questions posed above can be answered without additional studies. Existing studies designed to address different questions may be useful, e.g., Point Reyes Bird Observatory data on use of ponds in marsh, Martin Luther King marsh restoration intertidal pond (has 5 years of bird data).
- Design a test of prey abundance and bird use in existing ponds and marshes versus newly restored habitats.
- Manipulate features (pannes/salinas/ponds) to minimize mosquito problems and determine bird use and ecological function. Use existing Eden Landing pannes, create others.
- Implement an intensive experiment with a managed pond to determine actual bird use and management cost, e.g., A-16.
- Address scale issue by comparing different sizes of marshes and ponds within different sites.

Goal 3. Target Areas for Early Action

The NSP has previously emphasized the importance of learning from existing and ongoing restoration in the South Bay to inform the development of options for the entire Project. To achieve the SBSPRP goals in the face of scientific uncertainty, landscape complexity, and changing environmental conditions, adaptive management will be necessary, meaning that opportunities for early learning must be used as fully as possible. Thus, any restoration planned under the Initial Stewardship Plan (ISP) or as part of SBSPRP must be considered a pilot project and designed around scientific hypotheses, with rigorous monitoring, and an adaptive approach to achieving project goals.

At the charette, the group was asked to consider early opportunities for restoration and learning. Two categories of early actions were identified:

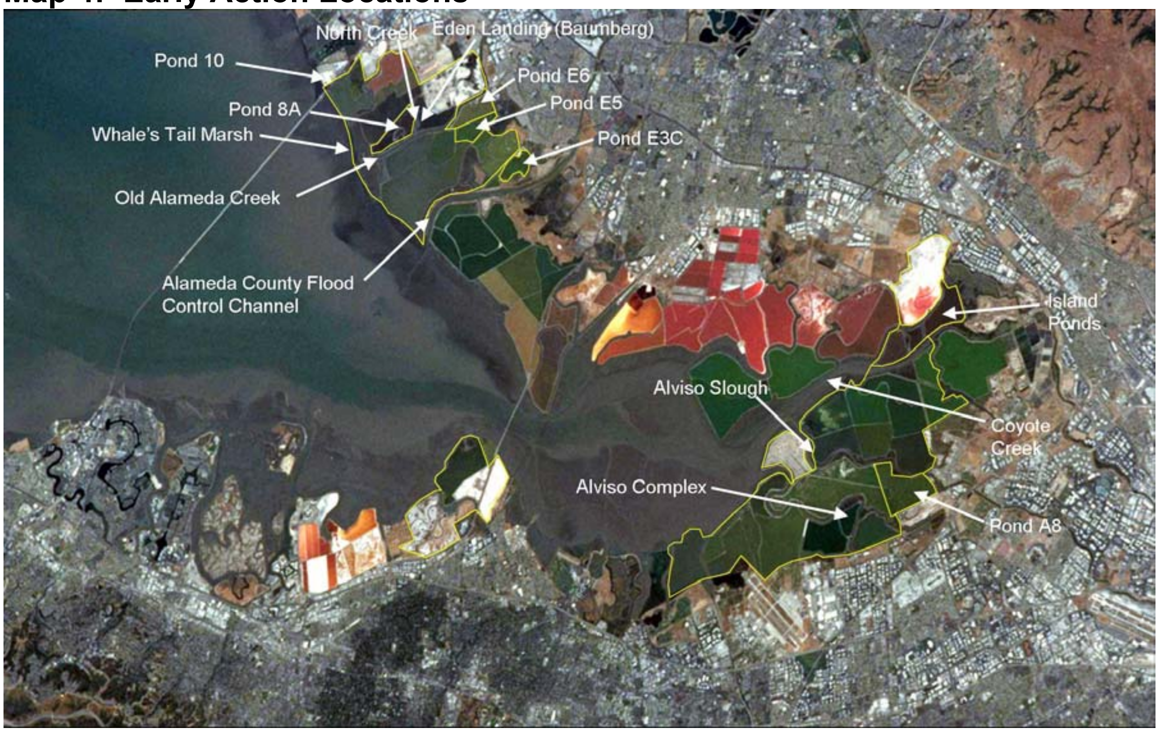
- Actions that would be clearly visible to the public and have a high probability of success in achieving stated goals and objectives. Specific target areas discussed in detail were the ponds at Eden Landing between Old Alameda Creek and Alameda Creek flood control channel, and Ponds A8/A9.
- Opportunities to collect data as part of restoration actions that are already planned under the ISP. These actions included breaching levees on the Island Ponds to connect Coyote Creek (planned for March/April

2006), and breaching levees in the Eden Landing/North Creek/Old Alameda Creek area (planned for April 2005–November 2006).

The group also noted that other current projects (not related to the SBSPRP) such as Bair Island and LaRiviere Marsh also provide opportunities for data collection but were not discussed in detail.

The locations of these target areas are shown on Map 4. The outcome of detailed discussion of four of these opportunities is reported here. In addition, some general recommendations were made regarding monitoring under the ISP.

Map 4: Early Action Locations



1. Eden Landing North Breach

Background

The entire Eden Land 835-acre restoration is scheduled to be operating tidally by the end of 2006, with a series of three breaches of their dikes. In April 2005, a breach will connect the south end of the North Creek channel (between Ponds 8 and 8A) with Old Alameda Creek, allowing water to flow from this channel through Old Alameda Creek and into the Bay. In Fall 2005 or 2006, the upper reaches of North Creek will be breached under the ISP, returning the southern portion of the Eden Landing restoration site to tidal flows and allowing the reestablishment of tidal marsh at approximately 350 acres of former crystalizer ponds. The third breach at this site is scheduled to occur by November 2006, and will restore tidal action in the former Mt Eden Creek channel. In addition to these planned breaches, Pond 10 is currently operating under muted tidal influence due to a broken tide gate. The Pond 10 intake/discharge structures will be constructed and begin operating once the Mt. Eden Creek channel is restored to tidal action.

At this point, a specific monitoring plan has not yet been developed. Based upon the permit requirements the monitoring that has been planned is minimal and includes rates of sediment deposition using sediment pins, a limited number of channel cross sections to look at channel scour, periodic aerial photos to monitor change, and primarily vegetative. This monitoring would be linked to transects to look at species composition, monitoring for invasive plants (particularly *Spartina* hybrids), and some limited bird monitoring. No fish or invertebrate sampling is planned.

<u>Study Recommendations</u>

These breaches will provide an opportunity to monitor development of the flora and fauna of the restored areas as well as physical and chemical changes. Testable hypotheses should be clearly identified and objectives of monitoring need to be more clearly spelled out. A monitoring plan should focus on testing the hypothesis to gather information useful for the long-term restoration planning, rather than just meeting permit objectives. There are also opportunities to evaluate different pond management strategies for the ISP. Several seasonal ponds exist, as well as some that will be managed as batch or higher salinity ponds. Some seasonal/diked habitats are subject just to rainfall, some have other managed water input. Some are managed specifically for snowy plover. Some provide important habitat for shorebird migration from late summer through winter. An opportunity is provided in conjunction with the refuge ponds and the remaining salt production ponds to evaluate the effects of various management strategies on birds, invertebrates, and fish, as well as chemical changes, i.e., mercury methylation. Various experiments can be set up in conjunction with the breaches; for example, isolating ponds with low-habitat levees that can be overtopped at high tides, or creating a large pond area by leaving a levee around it. Possible effects to evaluate include high salinity and low oxygen conditions. Also an opportunity exists to evaluate ways to deal with gypsum buildup in pond bottoms, since at least one pond (8A) has a significant gypsum layer.

2. Pond A8 North (Alviso Complex)

<u>Background</u>

The Alviso Complex is the largest complex in the South Bay, consisting of 8,000 acres and 25 ponds. In Spring 2004, the US Fish and Wildlife Service installed a series of new tide gates to stop the salt-making process in Ponds A1–A8. Water from these salt ponds now flows into the Bay through three 4-foot pipes.

<u>Study Recommendations</u>

Monitoring should be conducted to track the changes that occur over time, especially the initial, likely responses in both geomorphology as well as biological changes. First, it is important to establish baseline conditions for the current state of the channels and ponds. Because Pond A8 contains elevated levels of mercury, it is desirable to conduct monitoring and/or experiments at this location to determine changes in mercury methylation and bioavailability. This information could be useful to predict how mercury will behave in similar environments that are opened to tidal action.

Monitoring should also evaluate the development of tidal marsh habitat, using a nearby reference site such as Calaveras Point for comparison. Measurements should also be conducted to quantify sediment transport in the channel in Alviso Slough and to determine the direction of transport.

3. Island Ponds

The dikes at Island Ponds (A19, A20, and A21) are scheduled to be breached in March 2006 as part of the ISP. Five breaches will occur along Coyote Creek. Current permit monitoring includes sediment accumulation, vegetation colonization, scour effects on infrastructure and existing marsh, and salinity. However, these sites offer some of the better opportunities to investigate major uncertainties about methyl mercury availability under different restoration conditions and configurations.

Study Recommendations

Mercury monitoring should occur inside and outside ponds to evaluate the effects of tidal action and habitat changes. Mercury experts should be consulted to develop specifics of the monitoring regime. Experiments can be set up to evaluate the effects of ditch blocks adjacent to breach (ditch blocks would force water to enter ponds where an existing channel occurs).

This opportunity can be used to test different treatments of the gypsum layer at the bottom of ponds, such as scraping it off or leaving it in place and capping it. Instead of breaching, levees could be shaved down.

Recommended monitoring elements include changes in sediment accretion and plant colonization, fish and bird use, tidal ranges of streams and effects on breaches, water quality, and potential fish stranding in blocked channels.

4. Eden Landing/Alameda Creek Opportunities

The lower half of Eden Landing consists of 2,250 acres including (1) ponds between Old Alameda Creek and the Alameda Creek flood control channel, owned and managed by the California Department of Fish and Game, (2) diked vegetated marshes owned and managed by Alameda County, and (3) Pond E3C, which is currently owned by Cargill Salt but no longer managed for salt production and is linked to the ISP. This area would be a good location for early restoration, incorporating or advancing current plans under the ISP. The US Army Corps of Engineers built a flood control channel in 1972, with a 500-year flood capacity. The capacity has decreased drastically since then, and dredging or some other solution is needed to enhance the flood capacity. The existing topography is complex, with naturally occurring pannes and ponds. The site is already approaching or within the tidal elevation required for marsh colonization.

Design Recommendations

Ponds could be used for flood overflows, which could help provide natural scouring of the flood control channel. Design features could include breaching on Pond E3C (not yet acquired), J pond (pickleweed marsh), and some other ponds that border the flood control channel. Internal levees could be breached, leaving the levee along the Bay side intact. Islands could be developed inside the new tidal habitat. At Ponds E5 and E6 (which are more distant from the Bay) an opportunity exists to try different approaches to the development of panne/pond and transitional habitats. For example, within existing ponds, elevations could be increased to form internal levees for panne formation. The landward side should include a flood control levee with upland transition habitat down to the ponds, with the Bay Trail along the levee. Breaching will interfere with the existing trail, so this increase will compensate for that loss. An opportunity also exists to incorporate interpretive facilitates at historic salt works, and expand the dimensions of the riparian transition zone in concert with flood control levee construction.

Study Recommendations

Monitoring should include evaluation of persistence of pannes, their hydrology, seasonal character vegetation encroachment, bird use and behavior in pannes, sedimentation rates, vegetation colonization, development of transitional habitats, use by invertebrates, fish, birds, salt marsh harvest mice, and improvements in flood capacity. Important questions to consider are how the changes affect mudflats off of Eden Landing and what effects turbidity changes have on spring phytoplankton bloom? Whale's Tail Marsh could be used as a reference site to compare existing marsh within the area to formation of new marsh. Restoration in this area will also need to address the challenges posed by the existing extensive invasion of *Spartina*.

5. ISP Monitoring – General Recommendations

Monitoring stations should be located along sloughs and channels where discharge from ponds will occur. Given possible stratification in the receiving channels and potential for decreases in dissolved oxygen, mussels should be deployed for biomonitoring at different depths along pilings, to measure accumulation of contaminants in mussel tissue, and monitor mussel health at different depths. In addition, water quality and fish should be monitored. Such biomonitoring must be supported with vertical monitoring of water quality parameters. This information could be used to identify the spatial extent of potential adverse effects due to factors such as mercury methylation, high salinity, and low dissolved oxygen.

Data should be collected before, during, and after discharge. After discharge, the ponds could be closed to measure recovery in benthos and fish. Synoptic bird monitoring should occur simultaneously. Fish sampling, using appropriately sized mesh nets spanning breach openings, and/or pilings located inside and outside culverted or breached ponds should occur, the US Geological Survey is currently collecting fish and bird data, but this effort should be better coordinated to provide adequate and relevant baseline data. Such data collection can help plan managed discharges from ponds, which require high-salinity discharge for extended periods by understanding the effects of the discharge inside and outside the ponds.

Experimental restoration of oyster reefs and eelgrass beds could test the feasibility of establishing these habitats and assess their effects on the ecosystem, e.g., benefits to fish, including sturgeon, flounder, and leopard sharks, grazing of phytoplankton. Oyster restoration could utilize existing hard structures both near tidal marshes and away from tidal marshes. Eelgrass restoration may be limited south of Dumbarton Bridge by light conditions but should be explored, building on existing work by the National Oceanic and Atmospheric Administration.

APPENDIX A

SOUTH BAY SALT POND LONG-TERM RESTORATION PROJECT
Mission, Goal, Guiding Principles, and Objectives
February 19, 2004

Mission: To prepare a scientifically sound and publicly supported restoration and public access plan that can begin to be implemented within 5 years.

Goal: The overarching goal of the Long-Term Restoration Plan is the restoration and enhancement of wetlands in South San Francisco Bay while providing for flood management and wildlife-oriented public access and recreation.

Guiding Principles:

- The Long-Term Restoration Plan is based on the best available science, and independent scientific review is an integral part of its development and implementation.
- The Long-Term Restoration Plan is developed through an inclusive and open process that engages all stakeholders and interest groups at the earliest possible time and promotes partnerships and alliances across all interests.
- Numerous federal, state, and local agencies are partners in the Long-Term Restoration Plan and their views are considered fully.
- The Long-Term Restoration Plan is a flexible plan that is based on the concept of adaptive management – recognizing that information gathering is part of implementation and that modifications will be made in the future based on other information.
- The Long-Term Restoration Plan is implemented in phases, including achieving early, visible successes.
- The Long-Term Restoration Plan emphasizes naturally sustaining systems while acknowledging that management will be required to provide a mix of habitats.
- The Long-Term Restoration Plan integrates restoration actions at a regional scale to provide ecosystem-level benefits.
- Development of The Long-Term Restoration Plan will consider costs of implementation, management, and monitoring so that planned activities can be effectively executed with available funding. Partnerships and alliances will be formed to develop and institute a long-term viable funding strategy.

Objectives:

- Create, restore, or enhance habitats of sufficient size, function, and appropriate structure to:

  Promote restoration of native special-status plants and animals that depend on South San Francisco Bay habitat for all or part of their life cycles.

  Maintain current migratory bird species that utilize existing salt ponds and associate structures such as levees.

  Support increased abundance and diversity of native species in various South San Francisco Bay aquatic and terrestrial ecosystem components, including plants, invertebrates, fish, mammals, birds, reptiles, and amphibians.

- Maintain or improve existing levels of flood protection in the South Bay area.
- Provide public access and recreational opportunities compatible with wildlife and habitat goals.
- Protect or improve existing levels of water and sediment quality in the South Bay, and take into account ecological risks caused by restoration.
- Implement design and management measures to maintain or improve current levels of vector management, control predation on special-status species, and manage the spread of nonnative invasive species.
- Protect the services provided by existing infrastructure (e.g., powerlines, railroads).

APPENDIX B

A Charette for the South Bay Salt Ponds:
Developing a Landscape Vision Grounded in Science
Roster

Name	Affiliation	Email Address
National Science Panel		
Denise J. Reed (NSP Chair)	University of New Orleans	djreed@uno.edu
Jorg Imberger	University of Western Australia	jimberger@cwr.uwa.edu.au
R. Michael Erwin	University of Virginia	rme5g@virginia.edu
Charles ("Si") Simenstad	University of Washington	simenstd@u.washington.edu
Jerry Schubel	Aquarium of the Pacific	JSchubel@lbaop.org
John Teal	Woods Hole Oceanographic Institution	teal.john@comcast.net
Project Management Team		
Clyde Morris	US Fish and Wildlife Service	Clyde_Morris@r1.fws.gov
Nadine Hitchcock	California Coastal Conservancy	nhitchcock@scc.ca.gov
Amy Hutzel	California Coastal Conservancy	ahutzel@scc.ca.gov
Carl Wilcox	CA Department of Fish and Game	CWilcox@dfg.ca.gov
John Krause	CA Department of Fish and Game	JKRAUSE@dfg.ca.gov
Steve Ritchie	California Coastal Conservancy	sritchie@scc.ca.gov
Beth Dyer	Santa Clara Valley Water District	bdyer@valleywater.org
Jim Fiedler	Santa Clara Valley Water District	jfiedler@valleywater.org
Science Team		
Lynne Trulio	San Jose State University	ltrulio@earthlink.net
John Callaway	University of San Francisco	callaway@usfca.edu
Edward Gross	Consultant	ed.gross@baymodeling.com
Fred Nichols	Retired, US Geological Survey	fnichols@pacbell.net
Bruce Herbold	US Environmental Protection Agency	Herbold.Bruce@epamail.epa.gov
David Schoellhamer	US Geological Survey	dschoell@usgs.gov
Dilip Trivedi	Moffatt and Nichol	dtrivedi@moffattnichol.com
Josh Collins	San Francisco Estuary Institute	josh@sfei.org

Name	Affiliation	Email Address
Project Consultant Team		
Phil Williams	Philip Williams & Associates	p.williams@pwa-ltd.com
Michelle Orr	Philip Williams & Associates	m.orr@pwa-ltd.com
Ron Duke	HT Harvey & Associates	rduke@harveyecology.com
Speakers		
Mary Scoonover	Resources Law Group	mscoonover@resourceslawgroup.com
Rob Butler	Canadian Wildlife Service	rob.Butler@ec.gc.ca
Jim Cloern	US Geological Survey	jecloern@usgs.gov
Shirley Laska	University of New Orleans	SLaska@uno.edu
Maggi Kelly	University of California, Berkeley	mkelly@nature.berkeley.edu
Jeff Koseff	Stanford University	koseff@stanford.edu
Other Participants		
Phil Mineart	URS Corporation	Phillip_mineart@urscorp.com
Lou Armstrong	URS Corporation	Louis_Armstrong@urscorp.com
Mike Vasey	San Francisco State University	mvasey@sfsu.edu
Ron Kneib	University of Georgia	rtkneib@uga.edu
Mike Connor	San Francisco Estuary Institute	mikec@sfei.org
Jan Thompson	US Geological Survey	jthompso@usgs.gov
Diana Stralberg	Point Reyes Bird Observatory	dstralberg@prbo.org
Kate Schafer	Aquamarine Research	kateschafer@earthlink.net
Robert McAdory	US Corps of Engineers	Robert.T.McAdory@erdc.usace.army.mil
Letitia Grenier	San Francisco Estuary Institute	letitia@sfei.org
Jim McGrath	Port of Oakland	jmcgrath@portoakland.com
Dan Bruinsma	City of San Jose	Dan.bruinsma@sanjoseca.gov
Arthur Feinstein	Citizens Committee to Complete the Refuge	afeinstein@goldengateaudubon.org
Susan Peterson	Teal Partners	sbptrsn@comcast.net
Facilitation and Logistics		
Mary Selkirk	Center for Collaborative Policy	mselkirk@earthlink.net
Austin McInerny	Center for Collaborative Policy	austinm@sbcglobal.net
Greg Bourne	Center for Collaborative Policy	gbourne@ccp.csus.edu
Lisa Hunt	URS Corporation	Lisa_hunt@urscorp.com

APPENDIX C

A Charette for the South Bay: Developing a Landscape Vision Grounded in Science

February 27-28, 2004

Proposed Agenda

The charette goals are to:

- Describe in words and in a map the desired nearshore landscape of South San Francisco Bay in 2050 that the group believes is achievable and sustainable given the prevailing processes that are anticipated at that time.
- Identify the most important and uncertain of the processes/phenomena that will influence the desired end state in 2050, and identify the research approaches that would significantly reduce the uncertainty.

Sunday, February 27

9:00 – 9:15	**Introduction – Jerry Schubel** Introduce all participants, observers from the public, facilitators, and roving project experts. Lay out the general procedures for the two days and expected outcomes.
9:15 – 9:30	**Breakout Session Orientation – Jerry Schubel**
9:30 – 10:00	**Project Background** 1. SBSP Restoration Project background and objectives – Steve Ritchie 2. How will this project be judged – Mary Scoonover
10:00 - 12:00	**Landscape Vision Background**
10:00 – 10:20	**Applying science to landscape management – Jorg Imberger**
10:20 - 10:40	**The importance of the landscape perspective – Maggi Kelly**
10:40 – 10:55	**Break**
10:55 – 12:15	**Understanding the South Bay Landscape** • Circulation and sediments – Jeff Koseff (20 min) • The South Bay ecosystem - Jim Cloern (20 min) • Landscapes as habitats – Robert Butler (20 min) • Restoration in a human landscape – Shirley Laska (20 min)
12:15 – 1:15	**Lunch**

1:15 – 1:30	**Guidelines for Afternoon Breakout Sessions – Jerry Schubel** Each team will identify robust restoration strategies, likely outcomes, commonalities, and key uncertainties/questions on a landscape scale related to achieving the Project Objectives.
1:30 – 5:30	**Breakout Sessions** • Outcome 1: a map that identifies, on a landscape level, areas where opportunities for and constraints to achieving the Project Objectives exist. • Outcome 2: a list of issues including both their importance in achieving project objectives and the level certainty with which they can currently be addressed.
5:30 – 7:30	**Break and Dinner**
7:30 – 9:00	**Reconvene for Preliminary Report Out – Jerry Schubel** Compare outcomes and develop preliminary collective vision. Identify important common elements, conflicting elements, major uncertainties, locations where restoration Objectives are most achievable, locations affording opportunities to investigate key uncertainties.

Monday, February 28

8:00 – 8:20	**Introduction – Jerry Schubel** • Review Day 1's results and important issues • Day 2 Goals: o Refine the draft landscape vision and matrix o Use the information generated to identify priority information needs, suggested Adaptive Management experiments, and suggested locations for Phase I actions
8:30 – 10:00	**Breakout Session – First Topic** • Small groups to further explore issues considered both important and uncertain (info needs, desired approach, e.g., research, adaptive management experiments, etc.)
10:00 – 10:15	**Break**
10:15 – 11:45	**Breakout Session – Second Topic**
11:45 – 12:45	**Lunch**
12:45 – 2:45	**Reconvene – Jerry Schubel** 1. Overlay breakout findings on preliminary vision and reconcile them 2. Identify: a. Priority information needs b. Adaptive Management experiments
2:45 – 3:00	**Break**
3:00 – 4:00	**Wrap-up – Jerry Schubel** • Summarize results • Agree on report level of detail, authors, and timeline

APPENDIX D

Summary of Reports/Recommendations from Vision Teams

Red Team (Report by Dilip Trivedi)

Vision for 2050

- Maximize connectivity
- Alviso – marsh close to existing bay edge
- Leave some existing ponds as managed ponds
- Utilize high flows as “delta” area
- Ravenswood- tidal marsh
- Urban levee needed

Issues of High Importance/High Uncertainty

- Sediments important, but not as uncertain as some other issues

Importance

Use existing data/information Adjacency/connectivity Climate change Likelihood/impact of net loss of mudflats Impact of ISP Estimation of benefits Economics Public perception regarding vectors Sediment supply	Need data/information Consequences of spartina hybrids Habitat value/relative importance of pannes Can we substitute pannes for managed ponds? Pond depths, salinity, etc. Can we keep same carrying capacity? What is carrying capacity? Legacy contaminants - erosion, methylation, food web Public access impacts on wildlife
	Fisheries impacts - adaptive management, monitoring

Uncertainty

Blue Team (Report by Lou Armstrong)

Vision for 2050
This team's vision was influenced by the following constraints identified:

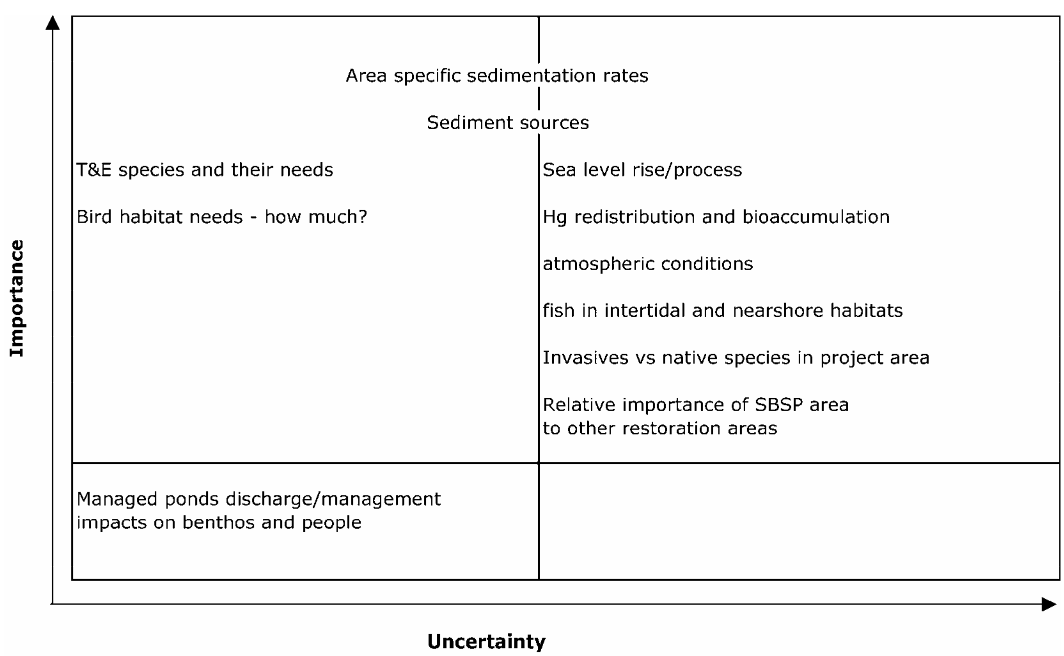
- Level of management (desired "sustainable" habitats)
- Mercury contamination
- Sediment availability
- Flood levee location
- Domain
- Existing trail/access features

Recommended Design

- South project area (Alviso) – mudflat area would be most appropriate (due to strong winds) with tidal marsh behind it, with some ponds – it would be a low maintenance mosaic tidal area with ponds associated with it. Alviso – Managed Ponds. Baumberg – Tidal Ponds.
- Edens Landing – same concept but add salinas that would naturally occur, also possibility of fisheries habitats.
- West side of Bay – larger-scale managed pond in addition to other mix of habitats.
- Maintain levee under area behind it is established – then let it erode away.
- Upland transition zone in between – intertidal zone and adjacent areas.

Issues of High Importance/High Uncertainty

- Mercury redistribution/bioaccumulation
- Sea-level rise and atmospheric conditions (emphasis on processes)
- Bird habitat – important but less uncertain
- Sediment availability over long term could be highly uncertain/important



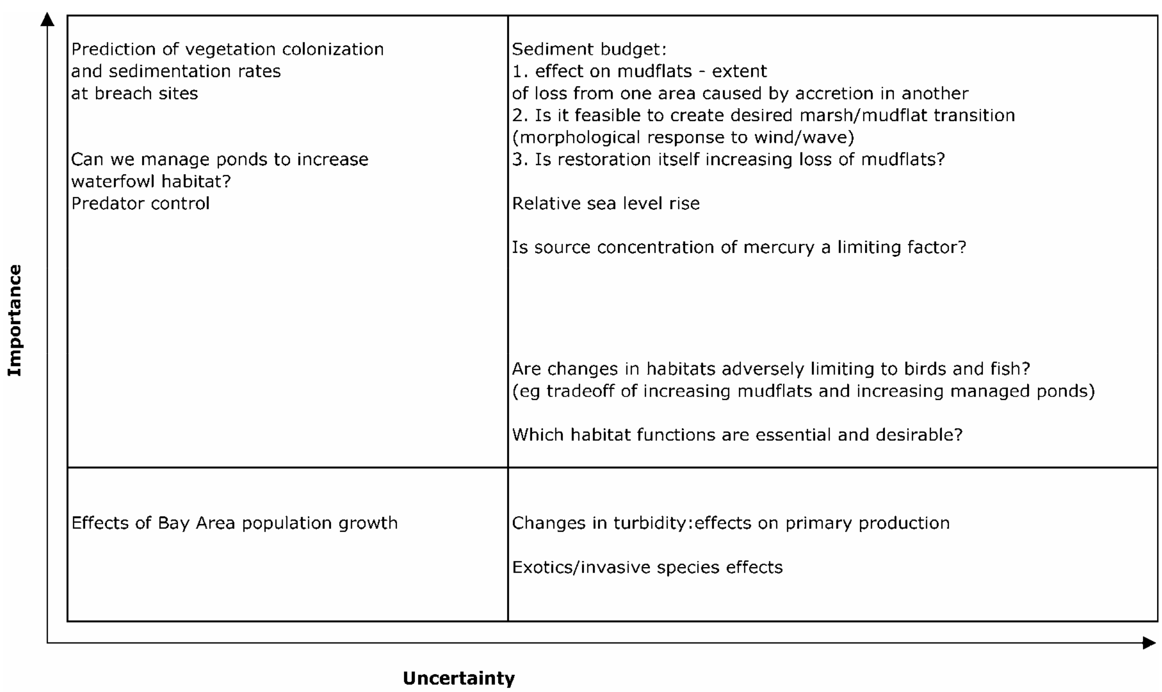
Green Team (Report by Mike Connor)

Vision for 2050

- Didn't focus so much on 50-year plan, but discussed phased/adaptive management approach.
- Risk of failure – mobilization of mudflat, mercury in Alviso/Guadalupe Slough area.
- Eden Landing – upland connection. Mudflat habitat to border Alviso southwest (due to prevailing winds).
- Boardwalks/public involvement.
- Cargill ponds as "adaptive management reserve."
- Small levees to intercept winds to create mudflats at Ravenswood.
- Small beach near bridge – take advantage of natural process that is creating it now.

Issues of High Importance/High Uncertainty

- Team considered as important "issues that would influence design."
- Mercury was uncertain, not high importance.
- Remobilization of sediments.
- Different estimates of relative sea-level rise.
- Wind/wave erosion behind levees.
- Invasive species was not so important – would not likely change design considerably.
- Sea-level rise is uncertain – so need adaptability in management.



APPENDIX E

Consolidation of Maps

At the end of the charette, the entire group considered a consolidated set of maps generated by the three Vision teams. Map 1 shows “existing conditions.” Maps 2 and 3 show two different versions of the charette’s vision for 2050. These figures are conceptual, and locations of various types of habitat are approximate. The differences between Maps 2 and 3 are a result of some of the uncertainties regarding the important processes, as outlined in the following points.

Eden Landing

- Good agreement among the three teams on what to do with Eden Landing - Beach, marsh with panne interspersed.
- Subtidal structures for surfperch or oysters.
- Beach habitat at Whale’s Tail.
- Endangered plant(s) that could benefit?
- Pannes toward back, with high marsh - Scatter them around marsh, not just at the back.
- Upland transition with levee at back.

Ravenwood

- Transition from mudflat to tidal marsh.
- Some ponds could be converted to mudflat. Some ponds could stay as managed ponds. Managed pond to east of bridge, mudflat to tidal on west side.
- Corridor of tidal marsh linking up other segments for anadromous fish moving through.
- Questions about opportunities for oyster restoration – would they grow this far south?

Alviso

- Western end of Alviso – high energy, exposed (appropriate for mudflats). Some opportunities for tidal marsh – transition from ponds to outboard mudflat.
- Uncertainty about use of marsh panne habitat by migratory birds.
- Upland transition opportunities. Marshes on both sides of Coyote Creek, panne habitat potential. Create gradient to high marsh habitat.
- Create “delta” at Coyote and Guadalupe outlets.
- Issue of mercury might be too risky in some areas – questions. If it is determined that mercury issues are not high risk, could create tidal marsh. If not, stay in managed ponds in high-mercury areas (Maps 2 and 3 show both options).

General Uncertainties/Questions

- Can pannes be recreated, and would they provide same quality habitat as managed ponds? If news not good, stay in managed ponds. (Maps 2 and 3 show both options)
- Questions about whether natural pannes really will provide good habitat for species of interest similar to current managed ponds.
- Least tern (listed species) feeds in managed ponds. Must include this type of habitat unless tidal marsh can provide same habitat for this species. Rate of sedimentation is unknown.
- Does opening ponds up cause unacceptable erosion on mudflats? This is an unknown. Could have loss of mudflats south of Dumbarton Bridge. Is potential loss of mudflats to build up deep ponds over next 50 years unacceptable?