

Issue Paper: Restoring Habitat with Science and Society in Mind

Delta Stewardship Council

January 2014

Executive Summary

One of the Delta Stewardship Council's roles is to promote habitat restoration and provide accountability for its implementation in the Delta and Suisun Marsh, an essential step toward restoring the Delta ecosystem while improving water supply reliability and protecting and enhancing the unique values of the Delta, as required by the Delta Reform Act (Water Code sec . 85054). Using the Delta Plan as its foundation, this issue paper builds on an Independent Science Board review and a Council oversight session, as well as work done by the Delta Science Program and the Delta Restoration Network, coordinated by the Delta Conservancy. The paper recommends ways to improve all stages of habitat restoration, from land acquisition to long-term monitoring, while respecting existing land uses and enhancing flood protection. While the Delta Plan envisions a broad range of habitat protection, restoration, and enhancement activities, the Plan's performance measures currently focus on the initiation of pilot projects in each of the priority habitat restoration areas designated by the Delta Plan and progress toward restoration acreage targets required by the biological opinions on the state and federal water projects' operations.

Introduction

The Delta Plan calls for restoring the Delta ecosystem while improving water supply reliability and protecting and enhancing the unique values of the Delta, as required by the Delta Reform Act (Water Code sec . 85054). The Delta Plan acknowledges that state agencies, our partners, cannot and should not try to turn back the clock and recreate the historical Delta ecosystem, an expanse of roughly 400,000 acres of tidal wetlands and other aquatic habitat linked to several hundred thousand acres of nontidal wetlands and riparian forest. However, we can restore specific areas to conditions that favor native species, taking into consideration changes that have occurred in the past, current land and water uses, and the future impact of climate change and other factors.

The Delta Plan regulations define the goal of protecting, restoring and enhancing the Delta ecosystem restoration as "successfully establishing a resilient, functioning estuary and surrounding terrestrial landscape capable of supporting viable populations of native resident and migratory species with diverse and biologically appropriate habitats, functional corridors, and ecosystem processes." Habitat restoration is a key element of ecosystem restoration, which also includes restoration of flows, improvement of water quality, and better management of nonnative invasive species, fish hatcheries and commercial and sportfishing.

One of the Delta Stewardship Council's roles is to promote and provide oversight for habitat restoration in the Delta and Suisun Marsh. In July 2013, the Delta Stewardship Council received the Delta Independent Science Board's report about the scientific research, monitoring, and assessment programs that support adaptive management of habitat restoration in the Delta (Water Code Sec 85280(a)(3)). In addition, the Council heard reports from several agencies about their activities to coordinate Delta restoration activities (Water Code Sec 85210(h)). In November 2013, the Council received a staff report

on progress toward addressing issues raised at the oversight session, including integration of habitat restoration with other Delta Plan goals and the use of performance measures to track progress and guide adaptive management. This paper provides additional analysis and recommendations to follow up on the oversight session, incorporating ideas from the Delta Science Plan and the draft Delta Restoration Framework, developed by a working group of the Delta Restoration Network, coordinated by the Delta Conservancy.

Efforts to build on:

[ISB Habitat Restoration Review](#)

[Delta Science Plan](#)

[Draft Delta Restoration Framework](#)

[Delta Ecosystem White Paper](#)

Using the Delta Plan as its foundation, this issue paper recommends ways to improve all stages of habitat restoration, from land acquisition to long-term monitoring, while respecting existing land uses and enhancing flood protection.

Habitat protection, restoration and enhancement as envisioned in the Delta Plan is quite broad, encompassing a wide range of planning and implementation activities, including coordination with the Delta counties' habitat conservation planning for terrestrial species and the enhancement of managed wetlands for waterfowl and other important species, as described in the Suisun Marsh Habitat Management, Preservation and Restoration Plan. However, the Delta Plan's performance measures currently focus on the initiation of pilot projects in each of the six priority habitat restoration areas designated by the Delta Plan (Figure 1) and progress toward achieving the targets of 8,000 acres of tidal marsh and 17,000 to 20,000 acres of floodplain habitat. The Council will evaluate progress using these Delta Plan's performances measures. In addition the Delta Plan policies require adaptive management—decision making in the face of uncertainty through a science-based process of setting goals and objectives, employing science-based designs, monitoring performance, and adjusting restoration activities, goals and objectives as needed to achieve the intended outcomes of the Delta Plan. These policies also require siting habitat restoration projects to avoid or reduce conflict with existing uses, such as agriculture and managed wetlands for waterfowl, where feasible. Measures of success include outputs, like acres of tidal marsh and floodplain habitat, and outcomes, like whether native fish and other important species populations are improving in abundance and resiliency. Projects not only must be designed to achieve their own objectives, but they must also fit together into a mosaic of diverse habitats, functioning migratory corridors, and ecosystem processes. Projects need to also consider flood risk, the potential to improve flood protection where possible, and provide opportunities to provide public access and recreation where feasible.

Lessons learned from this stage are expected to inform more ambitious restoration efforts that will require even greater coordination with farmland preservation, conservation of existing habitat, and flood protection efforts.

Effective Restoration Requires Balance and Good Judgment

Restoration Takes Time, Yet Time is of the Essence. Designing effective restoration projects within a landscape context takes time, yet time is of the essence in saving threatened species from extinction. Time is needed to identify appropriate sites for restoration within a landscape context, negotiate the purchase of property, conduct baseline assessments, identify project objectives and model linkages between proposed actions and objectives. Time is also needed to select the appropriate project design from a scientific perspective, evaluate potential impacts on neighbors and negotiate mitigation

measures, obtain permits, construct the project, and monitor the results. Even in the San Francisco Bay Area, where tidal restoration has been ongoing for 40 years, the time from acquisition to completion of construction has ranged from six to 28 years. Though these restoration timeframes can be shortened, as discussed below in the Recommendations section, planning and permitting does take time. Agencies, responsible parties, and the public, therefore, need to exercise a combination of patience and pressure.

Size Matters to Outcomes and Costs. Project size is very important to restoration outcomes as well as to implementation costs. A few large efforts tend to yield far more ecological functions than several small and isolated efforts, and large projects usually result in greater ecosystem diversity. Providing flood protection and other necessary accommodations for each project is costly, so reducing these costs by aggregating projects is critical in a funding-limited world. Buying, holding and managing properties until an effective restoration unit is achieved for construction may yield the most beneficial ecological and fiscal results, yet adds time to the process. Thus a balance needs to be struck between short-term restoration obligations, and allowing time for ecologically and economically optimal landscape-scale restoration.

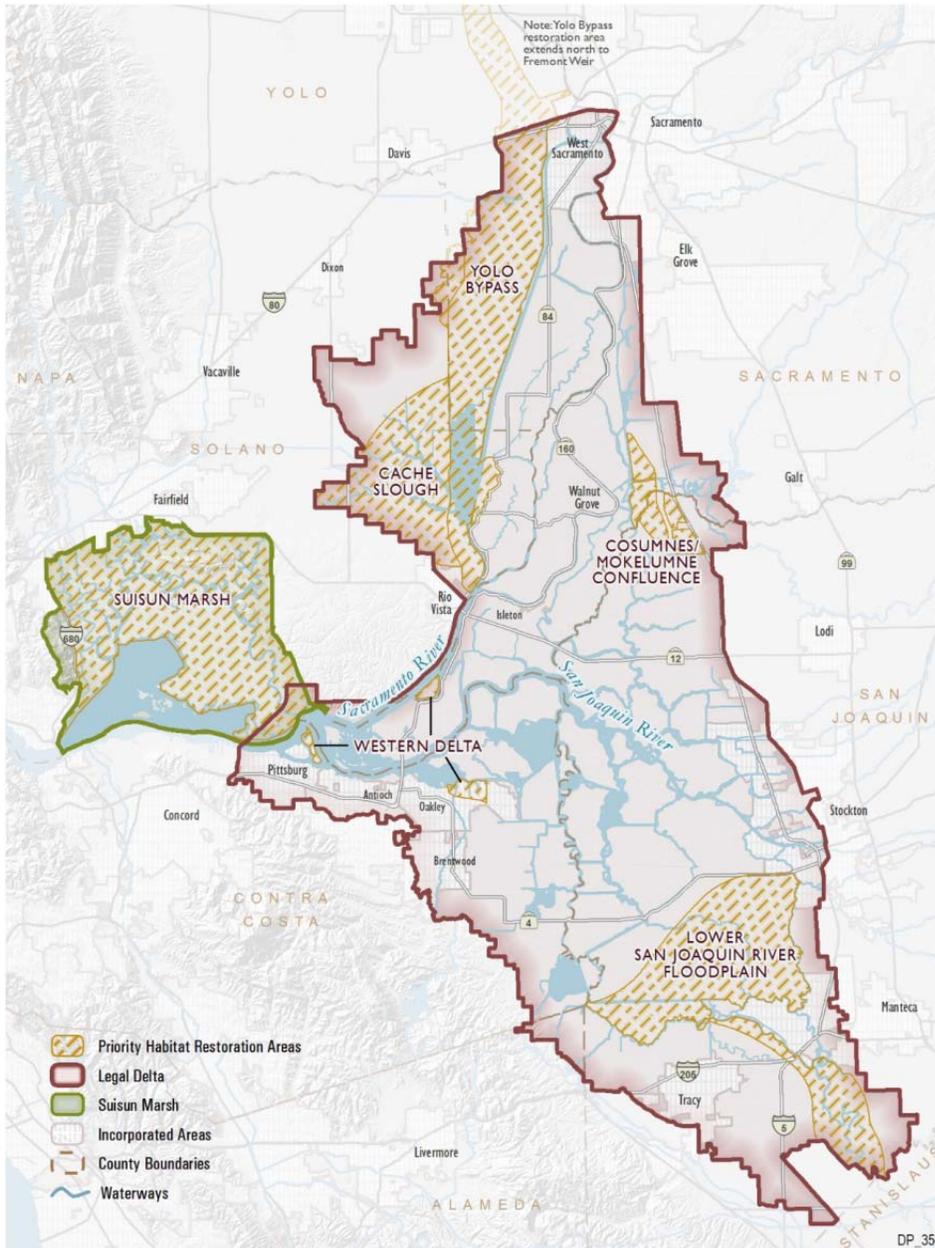
Science-Based Planning is Required. Restoration is often not as easy as breaching a levee or adding water to a floodplain. Site conditions, location, potential impacts to adjacent lands, potential changes to regional conditions, and other regional changes, all drive whether any particular effort succeeds or fails to provide ecological benefits to native species. The Delta has experienced several unintended levee failures. Some – like Sherman Lake breached in the 1920s and Liberty Island breached in 1998 – have yielded relatively positive habitat outcomes. Others – like the Frank’s Tract breach in the 1930s – have experienced rampant colonization by invasive species such as Brazilian waterweed, water hyacinth, Asian clams, carp and largemouth bass that can harm native species like delta smelt or salmon or, at a minimum, do not provide the quality of food and shelter of a tidal marsh dominated by native plants or of a pelagic habitat dominated by native plankton production. Therefore, the best available science should be used in restoration planning and design. At the same time, project managers must strike a balance between extensive modeling of alternative scenarios to determine the optimal project design and moving forward with a “good-enough” design and using the project as an opportunity for learning.

Measuring Performance Requires Good Judgment. Constructed restoration projects develop along a trajectory, from their conditions the day the levee is breached to some future conditions more typical of a naturally occurring habitat. Some ecosystem functions are present on the first day and remain for the long term. Others may rise and fall over time, along some general trend. Yet others may not develop for years, as in the case of areas that need time to build up elevations on subsided lands. In some cases, trajectories are in the wrong direction and corrective actions might be warranted. Agencies, responsible parties, and the public, therefore, need to allow restoration time to fulfill its targets while being watchful for failing efforts.

Location Matters. As noted in the Delta Plan, land elevation is a primary constraint on opportunities to establish target ecological functions. Deeply subsided Delta islands offer few opportunities to restore the forms and functions of the historical ecosystem, although they may be managed as wetlands for waterfowl and wildlife-friendly agriculture and to sequester carbon for climate change mitigation. The Delta Plan designates six areas that represent the most promising locations for habitat restoration, the less-subsided flood basins, river corridors, and brackish tidal marshes on the Delta’s perimeter: the Yolo Bypass, Cache Slough, Suisun Marsh, Lower San Joaquin River Floodplain, Cosumnes-Mokelumne Confluence, and some select areas in the Western Delta (See Figure 1.) Restoration of these areas is intended to create habitat and support food webs that can help recover native fish species, as well as

support native wildlife and plants. The Delta Plan's recommendation for restoration in these areas is based on the California Department of Fish and Wildlife's (DFW) Ecosystem Restoration Program's draft Conservation Strategy (2011) for restoration of the Delta, excerpts of which are included as Delta Plan appendices.

Figure 1. The Delta Plan's Priority Habitat Restoration Areas



Source: Delta Stewardship Council. 2013. *Delta Plan*, Figure 4-8. Sacramento, CA.

Restoration Acreage Must Be Tracked. The Delta Plan's performance measures focus on the initiation of pilot projects in each of the priority habitat restoration areas designated by the Delta Plan and progress toward restoration acreage targets required by the biological opinions controlling long-term operations of the state and federal water projects. The biological opinions require restoration of at least 8,000

acres of intertidal and associated subtidal habitats in the Delta, including the Suisun Marsh (USFWS 2008) and restoration of 17,000 to 20,000 acres of floodplain habitat (NMFS 2009) to be completed within 10 years, or by December 15, 2019. The Fish Restoration Program Agreement (FRPA) commits the Department of Fish and Wildlife (DFW) to assist the Department of Water Resources (DWR) in implementing the requirements of the biological opinions. Restoration under FRPA will be funded by DWR using funds generated by charges to the state water contractors. The State and Federal Contractor Water Agency (SFWCA) has an agreement with DWR to assist and cooperate in the acquisition and restoration of the required habitat. DWR, DFW, and SFCWA coordinate their restoration activities along with the Delta Conservancy.

Table 1 and Figure 2 provide an overview of projects being undertaken by DWR, DFW, SFCWA and others to meet the tidal and floodplain habitat restoration objectives of a range of programs, including, but not limited to, the Fish Restoration Program (FRP). In the case of several projects in the planning stages, the future extent of tidal marsh within the site is still uncertain.

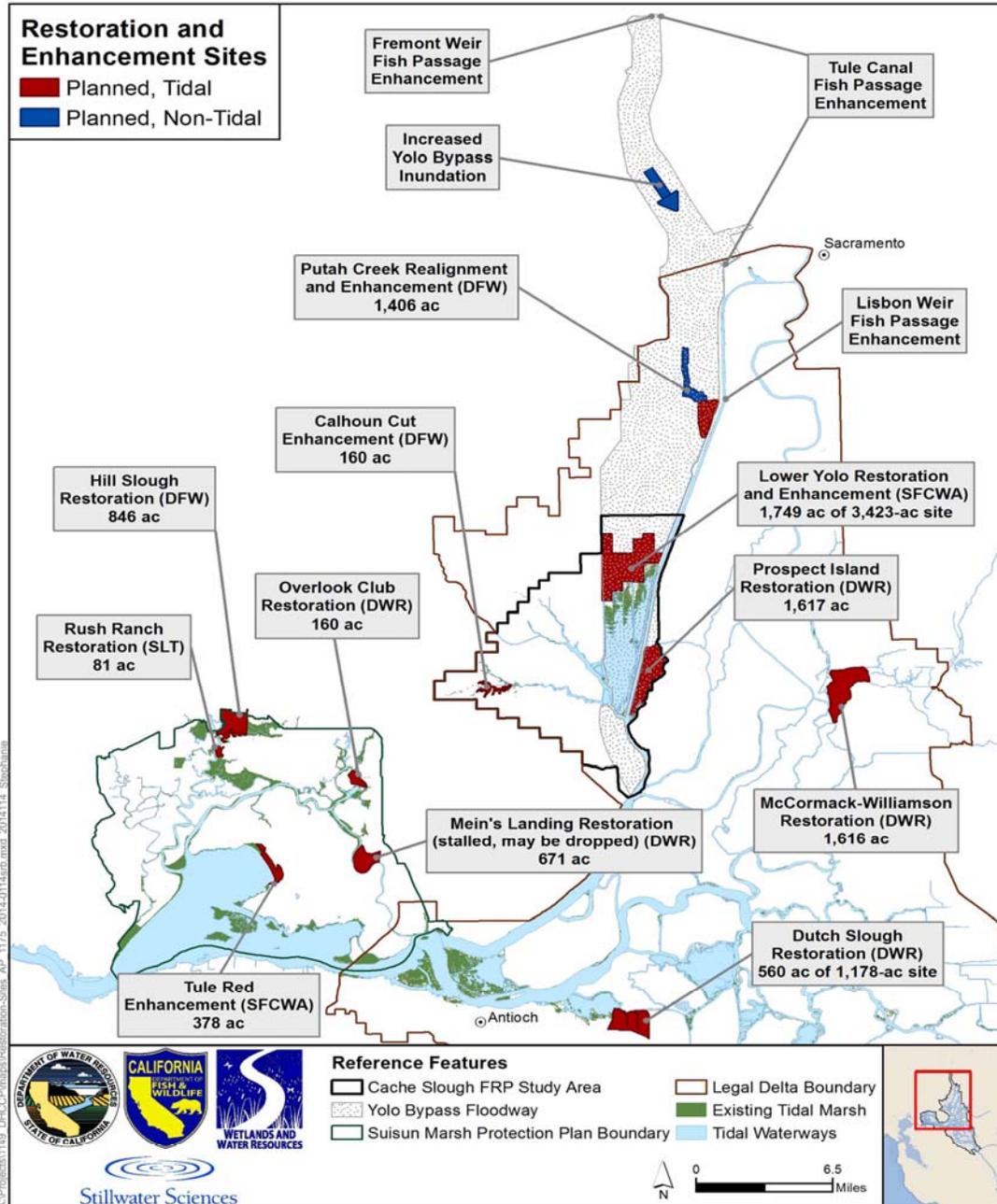
Table 1. Planned and Potential Tidal and Floodplain Habitat Restoration Projects and their Acreage
(Note: This table and the related figure below are still under review and may be revised in future versions of this paper.)

Project	Status	Entity	Tidal Habitat Restoration and Enhancement Acreage	Site Acreage
Lower Yolo Restoration and Enhancement	In Planning	SFCWA	1749 (restoration and enhancement)	3,423
McCormack-Williamson Tract Restoration	In Planning	DWR (FESSRO)	≤1595	1595
Prospect Island Restoration	In Planning	DWR (FRP)	≤1617	1617
Putah Creek Restoration and Enhancement	In Planning	DFW	758 (enhancement)	1407
Liberty Island Enhancement	Management Plan under preparation	DFW	Modest enhancement potential	4341
Calhoun Cut Enhancement	In Planning	DFW	160 (enhancement)	160
Little Holland Tract Enhancement	Under consideration for acquisition from Corps of Engineers	None	Modest enhancement potential	1457
Overlook Club Restoration	In Planning	DWR (FRP)	160	210
Hill Slough Restoration	In Planning	DFW	865	865

Tule Red Enhancement	In Planning	SFCWA	≤378 (enhancement)	378
Meins Landing Restoration	Planning on Hold	DWR (FESSRO)	≤657	657
Rush Ranch Restoration	In Planning	Solano Land Trust	81	81
Dutch Slough Restoration	In Planning	DWR (FESSRO)	560	1,178
Lisbon Weir Fish Passage	In Planning	DWR/USBR	NA	NA
Increased Yolo Bypass Inundation	In Planning	DWR/USBR	NA	NA
Fremont Weir Fish Passage	In Planning	DWR/USBR	NA	NA
Total			≤8,580	17,369

Source: DWR, pers. comm., 2014. SFCWA, pers. comm., 2014. Stuart Siegel, pers. comm., 2014.

Figure 2. Restoration and Enhancement Sites for Tidal and Non-tidal Habitat



Sources: Cache Slough Planning Boundary (WWR 2013-0708); Tidal Waterways (CDFG 2005 and BDCP 2012, WWR mod. 2013); Yolo Bypass (URS 2007, WWR mod. 2010); Restoration Sites (DWR 2011 and WWR 2013)

Figure 5-3: Public Agency and NGO Tidal and Floodplain Planned Restoration

Source: DWR, pers. comm., 2014. State and Federal Contractors Water Agency, pers. comm., 2014. Stuart Siegel, pers. comm., 2014.

Habitat acreage restored to meet the requirements of the biological opinions will count toward the acreage targets of the proposed Bay Delta Conservation Plan (BDCP), which calls for restoration of 65,000 acres of tidal habitat in the Delta and Suisun Marsh. The BDCP is being developed as a 50-year habitat conservation plan with the goals of restoring the Sacramento-San Joaquin Delta ecosystem and improving the reliability of California water supplies. The BDCP proposes building new water delivery infrastructure and operating the system to improve the ecological health of the Delta. The draft BDCP's tidal marsh restoration proposals are part of an overall program to restore or protect approximately 145,000 acres of habitat, including farmland that provides habitat for species of concern, such as Swainson's hawk and giant garter snake. While the habitat acreage goals of BDCP are far more ambitious than those required by the biological opinions, the BDCP's wider range of covered species and habitats potentially provides restoration practitioners and regulators with more flexibility in working to achieve a functioning landscape of diverse habitats.

Barriers to Restoration

According to testimony at the Council's oversight hearing, some of the main barriers to implementation include; conflicts with existing uses, land acquisition challenges, complex permitting, and insufficient funding for monitoring and adaptive management.

Conflicts with Existing Uses. Most potential tidal restoration sites in the Delta are farmed, often for hay or row crops. In the Suisun Marsh, most areas suitable for tidal restoration are currently managed for waterfowl production and hunting. Habitat restoration can conflict with these existing uses at the project or landscape scale. At the project scale, potential conflicts associated with aquatic habitat restoration include seepage onto adjacent properties, increased presence of endangered species or pests, and increased flood risk resulting from increased erosion of levees. At the landscape scale, large-scale habitat restoration could result in negative impacts to the agricultural economy and local government tax revenues, or the area's hunting heritage. In addition, where existing habitat values exist on lands targeted for conversion, significant conversion of habitat from one type to another could adversely affect species dependent on the habitat type that is lost, particularly if that habitat type is limited. In the Suisun Marsh, for example, tidal restoration may cause increases in local and regional salinities, compromising adjacent landowner current management capabilities; fragmentation and reduction of existing seasonal wetlands, some of which provide habitat for listed species; and the redistribution and reduction of abundance of wintering waterfowl.

Land Acquisition Challenges. Several entities are engaged in a range of habitat restoration and enhancement activities, as shown in Table 1, but it is likely that additional lands will need to be purchased to meet restoration acreage targets. The FRPA agencies are pledged to acquire restoration lands only from willing sellers. As a result, the pace of securing sites for tidal restoration is determined partly by landowners, not just restoration agencies. In addition, state agencies have complex requirements and procedures related to acquiring property. The Legislative Analyst's Office has warned that cost of the BDCP's restoration plans could increase significantly due to rising land prices sparked by the BDCP's demand for restoration sites.

Complex Permitting. Habitat restoration projects often require permits from multiple regulatory agencies. Permitting for mitigation projects is particularly complex because regulatory agencies have to directly relate the amount of mitigation required to a project's impact. However, even restoration projects that are not providing mitigation for impacts can be delayed by unpredictable requirements

and lack of standard guidance related to compensation for the conversion from one habitat type to another. Agencies involved in a range of construction and restoration activities, such as DWR, find it difficult to “bank” credits for habitat created in one project and use those credits to compensate for the impacts of another project.

Adaptive Management Challenges. Getting projects done right means learning from project implementation by following a three-phase adaptive management cycle. This includes setting clear restoration goals, as recommended by the ISB; conducting a baseline assessment to determine initial conditions and long-term monitoring to assess project effectiveness; and making management adjustments as needed. Proponents of habitat restoration projects are often limited in their ability to obtain funding for monitoring beyond regulatory requirements, due to funding limitations. Where monitoring data is collected, it is not always analyzed and synthesized or made available in a way that results in learning from a particular project.

Habitat Restoration Recommendations

The following recommendations are intended to address the barriers outlined above.

1. **Develop and implement regional conservation strategies to employ best science and manage conflicts.**

Habitat restoration must be based on the best available science and guided by adaptive management. It must also respect existing land uses in the Delta and Suisun Marsh, such as farming, fishing, boating and waterfowl hunting.

The Delta Conservancy convened the Delta Restoration Network, a group of agency and stakeholder representatives interested in promoting and coordinating habitat restoration in the Delta. Members of the Delta Restoration Network, including staff of the Delta Stewardship Council and its Delta Science Program, drafted a Delta Restoration Framework for a “scientifically credible, stakeholder trusted, cost-efficient, and co-equal goal-relevant program for restoration success,” consistent with the Delta Plan’s adaptive management framework. The Delta Restoration Framework calls for the development of regional conservation strategies to guide restoration in each of the six Delta Plan priority habitat restoration areas.

Efforts to Build On:

[Draft Delta Restoration Framework](#)

[DFW Ecosystem Restoration Program Conservation Strategy](#)

[Delta Landscapes Project](#)

[California Essential Landscape Connectivity Project](#)

[Yolo Bypass Fishery Enhancement Planning Team](#)

Regional conservation strategies are frameworks that support evaluation of a range of scenarios for habitat restoration that account for different configurations of farmland, waterfowl habitat, infrastructure, and flood protection facilities. These strategies serve as a guide to address practical land acquisition and restoration planning questions like “do we acquire it?”, “do we hold or restore it?”, “how do we address local concerns?”, “how do we address climate change and other sources of uncertainty?”, and “how does the restoration design fit into in the landscape context?” A draft of a Suisun Marsh Conservation Strategy was completed in 2011 under the auspices of The Nature Conservancy, and DWR is preparing a Cache Slough Complex Conservation Strategy focused on delta

smelt and juvenile salmon habitat restoration. Similar regional conservation strategies need to be developed for the remaining high priority areas.

As proposed in the draft Delta Restoration Framework, the strategies would evolve beyond the form of a static document to become a dynamic set of analytical and planning tools that would enable agencies engaged in restoration to combine adaptive management with accountability to stakeholders and public officials. Preparation of these regional strategies for each restoration opportunity area could speed restoration by reducing conflict with landowners and local agencies and creating context for design, environmental assessment, and permitting of individual projects.

The development of regional conservation strategies is consistent with Action 3.2 in the Delta Science Plan, regarding the use of adaptive management frameworks, and Action 3.3 in the Science Plan, which calls for modeling alternative future scenarios using interdisciplinary teams. This approach also provides a way to incorporate many of the recommendations in the ISB's habitat restoration review, including considering multiple criteria in selecting restoration projects, linking restoration projects together in strategic networks, and using scenario modeling and risk analysis to assess uncertainties and the potential costs and benefits of restoration actions.

DFW should use bond funds associated with its Ecological Restoration Program to support the Delta Restoration Network in implementing regional conservation strategies.

2. Prioritize restoration of public lands where appropriate, then acquire private lands.

Delta Plan Policy DP P2 states, "Plans for ecosystem restoration must consider sites on existing public lands, when feasible and consistent with a project's purpose, before privately owned sites are purchased." This approach can reduce both the time and the cost of acquiring property, as well as alleviate concerns that tidal restoration is unnecessarily converting farmland or waterfowl habitat.

The state currently owns land in areas designated as priority habitat restoration areas in the Delta Plan particularly DFW's 15,300-acre Grizzly Island Wildlife Area (GIWA) in Suisun Marsh, much of which is at elevations that the Delta Plan identifies as suitable for tidal restoration, based on DFW's draft Conservation Strategy. These areas, however, were acquired for wetlands management for waterfowl production and associated species and to provide public hunting and recreational opportunities. DFW is pursuing tidal restoration of the Hill Slough Unit of the GIWA and the inclusion of some of its lands in the Tule Red Project being pursued by the SFCWA (Figure 2). DFW will continue to evaluate restoration of tidal marsh on portions of GIWA where it is consistent with the purposes of the wildlife area and in the context of the *Suisun Marsh Habitat Management, Preservation, and Restoration Plan*, the *Baylands Ecosystem Habitat Goals Report* and the *Tidal Marsh Recovery Plan*.

Efforts to Build On:

[Suisun Marsh Habitat Management, Preservation, and Restoration Plan](#)

[Baylands Ecosystem Habitat Goals Report](#)

[Tidal Marsh Recovery Plan](#)

The Natural Resources Agency should direct DFW and DWR to proceed with restoration of state-owned properties in the Delta and the Suisun Marsh before purchasing private land, or provide an explanation of why restoration of these lands is not feasible or advisable.

3. Adopt agricultural land stewardship guidelines.

Since 2012, DWR has been convening an interagency Agricultural Land Stewardship Workgroup and consulting with agricultural and local interests to develop a set of strategies for use in addressing impacts of habitat restoration on farmland. Appropriate elements related to restoration project implementation, such as good neighbor policies, compensation for crop losses, payments for ecosystem services, and offers to involve landowners in transitioning their land from agriculture or managed wetlands to tidal or floodplain habitat, could be formalized into guidelines and distributed to agencies and other organizations engaged in habitat restoration through the Delta Restoration Network.

Efforts to Build On:

[Agricultural Land Stewardship Workgroup](#)

[California Roundtable on Agriculture and the Environment](#)

[Guidelines for Creating Effective Ecosystem Services Incentive Programs and Policy](#)

DWR, the Delta Protection Commission and the Delta Conservancy should develop guidelines for minimizing impacts of restoration on farmland, building upon the work of the Agricultural Land Stewardship Workgroup. The guidelines should be vetted with agricultural and resource agencies and stakeholders, including Delta local governments and community representatives.

4. Use best practices for acquisition of habitat land and conservation easements.

The staffs of various state agencies and nonprofit organizations have developed expertise in acquiring land and easements for habitat protection and restoration. They have specialized skills in evaluating the habitat value of large areas and specific properties, building relationships with landowners, conducting appraisals, negotiating transactions, and assembling funding from multiple sources when necessary. Some have specialized skills in acquiring land for wetland restoration projects. For example, DFW develops Conceptual Area Protection Plans that evaluate the biological values within an area so that acquisitions by the Wildlife Conservation Board, which serves as the DFW's land agent, need not undergo biological assessments on a property by property basis.

Efforts to Build On:

[Wildlife Conservation Board Land Acquisition Program](#)

[State Coastal Conservancy Wetland Restoration Progress](#)

[California Council of Land Trusts](#)

DWR, DFW, the Delta Conservancy, SFCWA, the Wildlife Conservation Board and other relevant agencies should compare land acquisition procedures, determine best practices, and explore opportunities for collaboration that could streamline the acquisition process. The agencies should also explore opportunities for effective partnerships with nonprofit affiliates.

5. Improve permit coordination.

Permit coordination can be improved by adopting best practices developed around the state. Some examples include establishing regulatory work windows to protect endangered species, holding interagency meetings that allow project proponents to meet with all regulators at once, and using programmatic permits and biological opinions. Programmatic permits for habitat restoration projects in the Delta, such as a Regional General Permit from the U.S. Army Corps of Engineers, could greatly expedite the permitting of individual projects. Regulatory agencies should build conditions into permits that focus required monitoring on supporting adaptive management.

The Natural Resources Agency should investigate whether programmatic environmental documents being developed for the Bay Delta Conservation Plan can provide a basis for programmatic permits for habitat restoration measures. In the interim, DWR, as the lead agency for FRPA and BDCP, should seek programmatic Clean Water Act permits and biological opinions for restoration activities in the Delta. In addition, the Delta Plan Interagency Implementation Committee should create workgroup to identify a set of permitting best practices and ensure their implementation.

Efforts to Build On:

[Existing Statewide Programmatic Permits](#)

[USACE Interagency Pre-Application Meetings](#)

[Single Application and Joint Review for Dredging in San Francisco Bay](#)

6. Use a common framework for wetland monitoring to track restoration progress and inform adaptive management.

The Delta Conservancy and partners received a grant to expand the coverage of the web-based project tracking database EcoAtlas to the Delta. EcoAtlas, which is a statewide database managed by the San Francisco Estuary Institute in collaboration with the Southern California Coastal Water Research Project Authority, Moss Landing Marine Laboratories, and the Joint Ventures, will provide restoration habitat acreage totals by habitat type, as well publicly accessible information about the project stage (planning, ongoing, or complete) and will contain links to related documents, including monitoring reports. Maintaining EcoAtlas for the Delta will require a source of ongoing financial support. Joint work by DFW and State Water Resources Control Board to require standardized wetland monitoring under the Wetland and Riparian Area Protection Policy is laying the groundwork for improved tracking of restoration progress through coordinated permit conditions, but it will take time to bear fruit.

DWR and its state and federal water contractor partners should support the Delta Conservancy in obtaining the necessary resources to maintain the Delta portion of the EcoAtlas as a means of tracking the progress of restoration efforts. DWR, DFW, the Delta Science Program and federal agencies should develop a comprehensive monitoring program to assess the ecosystem effects of restoration actions required under FRPA and BDCP as part of the Science Action Agenda.

Efforts to Build On:

[EcoAtlas](#)

[California Estuaries Portal](#)

[Wetlands and Riparian Area Protection Policy](#)

7. Establish reference sites.

Establishment of reference sites that currently provide good habitat value is an important tool for aiding the design of restoration projects. Long-term monitoring and studies of reference sites can provide insight into ecological processes that can be applied to management of restored sites.

The Delta Science Program in consultation with permitting agencies should consider the designation of reference sites as an element of the Science Action Agenda.

8. Report annually on restoration progress.

The Fish Restoration Program Agreement requires DWR, in coordination with DFW, to prepare an annual report on programs and projects being implemented under the agreement.

FRPA agencies should provide a copy of its annual report to the Delta Stewardship Council, regulatory and funding agencies, and the public. This will help the Council to track progress toward the habitat restoration acreage targets in the biological opinions, a Delta Plan performance measure.

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