FEASIBILITY and SUSTAINABILITY: Evaluation of large-scale restoration alternatives for Elkhorn Slough.

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Costs

Each of the large scale alternatives at the mouth would be very substantial public works projects. Tables 1 and 2 provide the engineers estimated costs for the New Ocean Inlet and the Low Sill.

Table 7-1. Engineer's Estimate for Alternative 2 - New Ocean Inlet

Item	Description	Estimated Cost
1	Mobilization	$ 4,000,000
2	New Channel and Reuse	$ 39,000,000
3	Dredge Ocean Inlet	$ 6,000,000
4	Jetties	$ 8,200,000
5	Tidal Dam at Highway 1 Bridge	$ 3,800,000
6	New Highway 1 Bridge and Approaches	$ 8,700,000
	SUBTOTAL	**$ 69,600,000**
	CONTINGENCY (35%)	**$ 24,400,000**
	TOTAL	**$ 94,000,000**

Table 7-2. Engineer's Estimate for Alternative 3a - Low Sill at Highway 1 Bridge

Item	Description	Estimated Cost
1	Mobilization	$ 1,500,000
2	Fill Placement in Elkhorn Slough Channel	$ 15,000,000
3	Low Sill and Tidal Barrier	$ 3,500,000
	SUBTOTAL	**$ 20,000,000**
	CONTINGENCY (35%)	**$ 7,000,000**
	TOTAL	**$ 27,000,000**

In addition to the costs estimates for construction, considerable resources would be required for environmental compliance (CEQA/NEPA), permitting, engineering, project

management, construction management and monitoring. For comparison, the Parsons Slough Sill project will incur approximately $2 million in those costs. Because of the considerable complexity of these large scale projects, I estimate those costs at roughly $12 million for the New Ocean Inlet and $5 million for the Low Sill.

The process of making changes to Highway 1 and bridges that would be required for the inlet option would possibly add another major layer of extended and cumbersome process with CalTrans which does its strategic planning far in advance and would have to be convinced of the importance and high priority for this project.

Either of the large scale alternatives proposed at the mouth would interfere with existing recreational and commercial access to Elkhorn Slough, the sill by its creation of a standing wave at certain tidal heights, and the New Ocean Inlet by blocking water access except through the new inlet itself. In developing conceptual level cost estimates we should assume that this impact would be addressed by the construction of new boating facilities east of Highway 1 or similarly costly measures. I estimate those costs at $3 million.

There are also significant issues that would have to be negotiated and resolved related to 1) the “safe harbor” designation by the US Coast Guard of Moss Landing Harbor, which mandates that nothing can change the relatively smooth waters that allow boats to take refuge there during storms and in distress; 2) destruction of habitat for endangered species and 3)encroaching on potentially sensitive adjacent archeological sites that could cause additional opposition and raise the costs of getting permissions. The Safe Harbors issue itself could kill both projects if engineers found that wave action in the Harbor were exacerbated and posed a danger.

Combining construction and non-construction costs, the total project costs for the New Ocean Inlet is approximately $109 million.

The Low Sill estimate includes a substantial quantity of sediment additions to fill deep scoured portions of the main channel to both reduce the risk of water quality problems associated with stratification and help restore the sediment balance of the estuary. The Low Sill could potentially be implemented at lower cost with less sediment additions, depending on future studies of water quality and sediment budget. The total project costs for the Low Sill are $35 million including fill placement, and approximately $15 million without fill placement. A phased implementation of the Low Sill could cost less initially. All figures are in today’s dollars.

If the project is undertaken as a project of the U.S. Army Corps of Engineers (see funding strategy below), this will likely affect the cost. The USACE process is generally longer and more expensive than locally led undertakings. Therefore the above project cost estimates are increased by 30% when considering Corps involvement. Based on the costs estimated above and the 30% Corps add-on, the federal and local sponsor shares for both projects are outlined in the table below.

Under USACE cost-share agreements, estimated costs are inflated each year and a 20% cost-overrun is assumed. Thus, the $52 million local sponsor cost share for the new ocean inlet, would quickly rise above $60 million. These cost increases are allowed to occur without input or control from the local sponsor.

	New Ocean Inlet	**Low Sill with sediment**
Planning costs (50/50)	$15,600,000	$6,500,000
USACE	$7,800,000	$3,250,000
Local Sponsor	$7,800,000	$3,250,000
Implementation Costs (65/35)	$126,100,000	$39,000,000
USACE	$81,965,000	$22,815,000
Local Sponsor	$44,135,000	$13,650,000
TOTAL	**$141,700,000**	**$45,500,000**
USACE	**$89,765,000**	**$26,065,000**
Local Sponsor	**$51,935,000**	**$21,450,000**

Funding Strategy

Because of the substantial costs associated with these projects there are relatively few pathways to implementation. Completing the implementation process would likely require multiple sources of funding in parallel.

1. Army Corps

The U.S. Army Corps of Engineers (USACE) is frequently the lead agency with respect to financing large scale wetland restoration projects. The Army Corps has a mission to preserve, restore and maintain the nation's waterways, and lead the management of the Federal Channel at Moss Landing Harbor. The Army Corp received authorization from the U.S. Congress to conduct a feasibility study in Elkhorn Slough for the purpose of restoring environmental conditions, which would be the first of several steps in a process to identify a preferred alternative and, if appropriate, implement it. The groundwork laid by the Tidal Wetland Project would greatly facilitate this process, but would not replace it. Appropriation of funds by the US Congress is required to initiate that process. A $100,000 appropriation would be required to initiate and map out the process. To implement that process, an additional appropriation would be required and a local sponsor would be required to commit fifty percent matching funds.

2. California State Agencies

   The State Coastal Conservancy, the Wildlife Conservation Board, and to a lesser extent other state agencies issue grants or cost share agreements for wetland restoration projects. Typical grant program awards would likely be substantially less than the amount required to demonstrate local matching funds. Larger funding amounts would require an exceptional grant award. In order to receive State funding in the $10-50 million range, either project would need to be among the highest priority projects in the State, and may need to be specifically identified in the state budget or a ballot proposition. State agencies are also required to evaluate a project's resiliency to a 16-inch sea level rise (SLR) by 2050 and a 55-inch SLR by 2100. Neither project shows long-term resiliency to SLR which could significantly reduce competitiveness relative to other priority projects in the State.

3. Private Foundations

   Private foundations including the David and Lucille Packard Foundation, the Gordon and Betty Moore Foundation, and the William and Flora Hewlett Foundation have made substantial contributions (in the $1-10 million range) to wetland restoration projects in Northern California, which have been directed towards the costs of planning, regulatory compliance and design.

4. Federal Agencies and Other Federal Sources

   Grant funding is also available from Federal agencies including the US Fish and Wildlife Service (FWS) and the National Oceanic and Atmospheric Administration. Maximum grant awards, however, are rarely above $1 million. To receive significant project funding through any federal agency, including the USACE, will likely require an act of Congress and will likely require support from the Office of Management and Budget. However, if the project is led by the USACE, no federal grants can be used to help provide the local sponsor match.

Implementation Timeline

Project implementation would consist of several steps that could be conservatively estimated as being sequential. Of paramount importance to funding agencies and organizations is that any project of this magnitude be broadly supported. Prior to soliciting funders, broad agreement on the appropriateness of the restoration strategy would be required. This timeline would begin when that broad agreement is reached. It is clear that additional technical investigations and stakeholder engagement will be required to reach that point.

Table 3. Timeline to implementation

Task	**New Ocean Inlet (with USACE)**	**Low Sill (with USACE)**	**Low Sill (without USACE)**
Secure appropriation for Army Corps study	1 year	1 year	Not applicable (NA)
Conduct initial Army Corps study	1 + year	1 + year	NA
Secure funding for feasibility study	2 to 5 years	1 to 2 years	2 years
Conduct feasibility study, alternative selection and planning process	3 to 5 years	2 to 4 years	2 years
Conduct environmental compliance (done concurrently in USACE process)			1 to 2 years
Secure Congressional approval of new USACE project	2 to 5 years	2 to 5 years	NA
Secure local sponsor commitment	Not feasible	1 to 2 years	NA
Secure funding for final engineering and regulatory compliance	2 years	1 to 2 years	2 to 3 years
Conduct final engineering and regulatory compliance	2 to 4 years	1 to 3 years	1 years
Secure funding for construction	0 to 3 years	0 to 3 years	0 to 3 years
Construction	5 to 10 years	2 years	1 to 2 years
Total	**22 to 36 years**	**12 to 25 years**	**9 to 13 years**

Once underway, this time frame and required fund raising are not in anyone's interests. They imply that the current situation could not be significantly altered for several decades, additional fund raising for smaller projects would be very difficult, and the Slough would probably be worse off than considering the smaller, simpler and less expensive options for restoring parts of the saltmarsh and dealing with the nutrient overload.

Institutional Support

Substantial institutional support would be necessary for planning, implementation, and maintenance of the project. This support would be necessary to champion the project, secure funding, steward the design process and ensure that the requirements of the local partners are met, and to maintain restoration structures into the future..

Local Sponsor

If the project is implemented as an USACE project, it will require a public agency to be the local sponsor. For either alternative, the California Department of Fish and Game (CDFG) would be the most likely choice. As the local sponsor, CDFG will have to enter two cost-sharing agreements with the USACE – one for the feasibility study and one for implementation. For both phases, CDFG will have to commit at the outset to providing the full local sponsor share of costs; however, CDFG will not actually need to have those funds in hand at that time. Despite this, , one of the biggest challenges is to coordinate financing and permits. Without letters of commitment and money available, the project could fall apart if the money is not there when needed under permit deadlines.

Staffing

In order to provide the necessary level of support, a minimum of one full time dedicated CDFG staff person would likely be necessary for the full duration of the project. This staff person should be at a high enough level in CDFG that they can communicate directly with CDFG management able to direct and commit CDFG resources, negotiate directly with USACE staff, negotiate with other State agencies for project funding, and represent CDFG in a variety of forums including to State and federal elected officials. Dedication of less than full time would lengthen the overall timeline. One strategy that could be considered would be funding the full time staff person to ensure they prioritize the project. It's fairly common to see a project applicant provide funding for a full time agency staff person in instances where the project is very time sensitive.

A significant, ongoing commitment of CDFG legal staff will also be required. During most phases of the project up to several other staff would also be required for project management and coordination. If the Elkhorn Slough National Estuarine Research Reserve (ESNERR) is a partner on the project, these roles could potentially be handled by ESNERR staff. Understaffing during those periods would risk the project going off track in ways that could reduce the likelihood of completing the project or otherwise compromise timelines, budget and/or quality.

Guidance from experienced partners and technical advisory committees would be essential.

Political and Public Support

In order to raise the funding necessary for either project, the project will need a very high level of political support. This will need to include support from the project area's U.S. Congressional Representative, both members of the State Assembly and State

Senate, and the County Supervisor. Given the high costs of the projects, support from one or both of the State's U.S. Senators will likely be needed. The support from these elected officials will likely include written and verbal support, participation in high level meetings, and willingness to sponsor key legislation. To secure the support of these elected officials, the project will also need the support of both State and Federal resource and regulatory agencies. The project will also require a strong consensus of support from environmental organizations and stakeholders in Elkhorn Slough. Controversy or skepticism about the project's importance and urgency will make it impossible to raise the necessary funding.

Maintenance

The institutional support and budget necessary for project maintenance has not been fully characterized by the conceptual designs. Both projects could affect maintenance costs incurred by several landowners. Development of a mechanism to finance these costs would be an essential element of the planning process in order to secure support for the project. The New Ocean Inlet could potentially affect maintenance costs incurred by the Army Corps of Engineers (harbor dredging), Moss Landing Harbor District (harbor dredging), the Department of Fish and Game's Moss Landing Wildlife Area (bank protection), and Caltrans (bank protection, bridge maintenance), The new ocean inlet may be susceptible to closure. Inlet closure could substantially affect water quality within the Slough and require mechanical intervention (breaching) since no significant source of freshwater discharge is available to naturally re-open the inlet as occurred historically with the Salinas River. Mechanical breaching of the new mouth would require ongoing support from California State Parks. The Low Sill could potentially affect the Moss Landing Harbor District (harbor dredging) and Caltrans (bank protection, bridge maintenance).

Both projects could be implemented in a phased manner guided by an adaptive management approach. Such an approach would add to staff costs, but potentially result in savings through reduced construction costs or mitigation requirements. The Low Sill could be initially constructed at a very low elevation, with successive additions of material over time, or the design could be altered to include adjustable elements. The New Ocean Inlet could be implemented in sequence with the Low Sill following a period of observation, and only if deemed necessary to achieve project goals. Implementing any project in an adaptive management context requires substantial additional institutional commitment and resources. A minimum of two full time positions would be required for this purpose, and if those were the only dedicated resources, the dataset would be sparse. A coordinator for the adaptive management process would be required as staff of a key partner organization, and in addition to process management they would need to contribute to the various components of adaptive management monitoring, including water quality, bathymetry, and fish and wildlife movement. The other essential position would maintain the ESNERR long term water quality monitoring program. Competitive grant funding, because of its intermittent and uncertain nature, is

unreliable for those purposes. Program quality could be considerably enhanced with additional staff, and the datasets could be punctuated by occasional, more expensive and detailed studies funded through grants.

Table 4. Operations and maintenance costs

Annual costs, additional	**New Ocean Inlet**	**Low Sill**
Army Corps, dredging	undetermined	undetermined
Moss Landing Harbor District, dredging	undetermined	undetermined
Caltrans, bridge and bank maintenance	undetermined	Undetermined
Department of Fish and Game, bank protection	undetermined	$0
State Parks, inlet dredging	undetermined	$0
Adaptive management (minimum)	$140,000	$140,000

One other item that should be considered is potential compensation, at least for local businesses that might be affected by changes incurred by these options. The two kayak businesses, the Elkhorn Slough Safari and other local enterprises could lose clientele if entry to the Slough were to be inhibited. If the nature of wildlife in the Slough were to change, e.g. Sea Otters were unable to gain easy access for food and shelter, tourism could be deeply affected. These are just some of the additional costs that could be incurred that have not been estimated above. And, of course, if certain flatfish that spawn in the Slough were unable to swim across the barriers, both recreational and commercial fishing could be affected. The annual flatfish fishery that relies on Elkhorn Slough is $40,000 annually.

Conclusions:

Expensive, large scale projects in Elkhorn Slough to address tidal scour and marsh loss will be feasible only if they are broadly supported and represent a good long term investment. The two large scale alternatives under consideration are flawed from the perspective of feasibility and sustainability. This is the combined result of cost, controversy, and the likelihood of long term effectiveness. Because of the high costs, extensive federal, state and local partnerships would be required. Broad and deep community support would be essential to generate the considerable political will necessary to make the project competitive for public investment funding on a statewide and national basis. Public funding requires that such a project must accomplish its goals in ways that are resilient to sea level rise induced by climate change.

<u>New Ocean Inlet</u>. Given the size of this project, it would be highly unlikely that it could be implemented without federal funding through the USACE. This would require

approximately $52 million in local sponsor match. Given the lack of resiliency to sea level rise, existing functions of the system, and significant competition for State restoration dollars, it is highly unlikely that the state would be able to provide these funds without overwhelming political and public support for the project. This project is deemed infeasible on the basis of cost, high risk to the ecosystem, and lack of a strong consensus among ecological stakeholders that it is the best approach.

Low Sill at Mouth. The low sill concept has several significant challenges, including a high cost estimate, unknown effects on navigation, water quality, and animal passage, a complex permitting process, potential economic and recreational impacts and modest support from the scientific and management community. Nonetheless, the low sill remains a potential solution to reduce tidal scour in the slough and should be reevaluated, in five years, in light of experience with the functioning of the Parson's Slough sill.

Future efforts. If they are to be considered eligible for the substantial state and federal funding required to implement large scale projects, which is a key component of a feasible project, future efforts to conserve tidal marsh and soft subtidal habitats in Elkhorn Slough should demonstrate the following attributes:

*** Strong support from most stakeholders, associated with few unmitigated impacts and well-managed risk,**

*** Resilience to predicted rates of sea level rise**

*** Cost competitiveness relative to other similar projects**