

Date: October 15, 2008
From: Ballona Wetlands Science Advisory Committee
To: Ballona Project Management Team

Background and Overview

The purpose of this memo is to summarize the Ballona Wetlands Science Advisory Committee (SAC) technical review of the Ballona Wetlands Restoration Feasibility Report and to make recommendations to the Project Management Team for the development of more refined alternatives prior to the CEQA/NEPA environmental review.

One of the primary purposes of the SAC is to provide advice on science-based objectives for restoration and on the evaluation of restoration alternatives. Over a series of meetings, the SAC provided substantial input on the project's ecosystem restoration goals and subgoals. The overall goal of the project is to restore, enhance, and create estuarine habitat and processes in the Ballona Ecosystem to support a natural range of habitat and functions, especially as related to estuarine dependent plants and animals.

After input from the public, environmental organizations, and agencies, five conceptual project alternatives were developed by the project's consultant team which reflects possible restoration actions. The alternatives represent a continuum that ranges from preservation and enhancement of existing upland and wetland habitats to restoration and creation of a tidally influenced wetland system, including partial realignment and restoration of the lower portions of Ballona Creek/Flood Control Channel. It is also recognized that variations of these alternatives are possible.

To assist the project team in evaluating how the five alternatives meet the project goals and sub-goals, the SAC developed more specific "measures of change". The purpose of these measures was to identify a common means of comparison, quantified when possible, for the alternatives. The Restoration Feasibility Report applied the measures of change to each of the five project alternatives to compare how each alternative would be expected to meet the project goals. The Restoration Feasibility Report was reviewed by the SAC members and extensive comments were incorporated into the final version to ensure the report was technically accurate. With the exception of the sections on public access and costing (which are beyond the scope of the SAC's review), ***the SAC endorses the analysis provided in the Restoration Feasibility Report for use in subsequent stages of alternatives development and review.***

Although the Restoration Feasibility Report includes preliminary cost estimates, alternatives were compared only in relation to the project goals and subgoals, without regard to cost. In addition, the alternatives were only evaluated for conceptual feasibility; additional work is needed to determine if there are barriers (such as easements, public health and safety, or environmental constraints) that affect

the logistical, legal, or practical feasibility of a given approach. In developing more refined project alternatives for the environmental review process, the SAC recognizes that the Project Management Team will need to balance factors such as cost and practical feasibility to develop alternatives that best achieve the project goals.

The conclusions and recommendations below address only the ecosystem restoration goals of the proposed project. They focus on critical restoration choices that will affect the function of the habitat ultimately restored at the site. The purpose of these recommendations is to help the Project Management Team to develop more refined project alternatives that achieve the project's ecosystem restoration goal. Refined alternatives could include incorporating elements from several alternatives to produce a "hybrid" alternative that best achieves the project goals.

Relationship Between Alternatives and Project Goals

The Restoration Feasibility Report summarizes a number of trade-offs between different restoration approaches. Although the project area is 600 acres, making it the largest wetland restoration project in Los Angeles County, it is much smaller than its historical extent and is now surrounded by development. Consequently, restoration of one type of habitat may limit the area available for another habitat type. There are also a number of choices with regard to the hydrology of the restoration project that will affect the habitat function and its long-term sustainability.

The Science Advisory Committee agreed upon the following subgoals in support of the overall ecosystem restoration goal for the project:

1. *Habitat*: Preserve, restore, enhance, and create a variety of functional wetland and estuarine habitats representative of the Ballona Ecosystem.
2. *Biodiversity*: Preserve and increase the native biodiversity of the Ballona Ecosystem. Identify and protect multiple levels of diversity (e.g. species, habitats, biogeographic provinces and trophic structure).
3. *Physical/Chemical Processes*: Maintain and establish physical and chemical processes consistent with the restoration goals.
4. *Sustainability*: Facilitate the conservation and restoration of natural resources in a manner that maintains and improves the ecological integrity, function, diversity and productivity for future generations.

The SAC developed a number of measures of change to evaluate how the restoration would address the subgoals and objectives for the project. The SAC determined that the goals and objectives could best be met based on the following criteria.

1. Maximize area of estuarine habitat.

The SAC believes that the best way to achieve the habitat goals is to through the restoration of a functional estuarine habitat that includes shallow subtidal, mudflats, fully tidal wetlands, salt pan and transitional habitats. Tidal estuarine habitats would benefit vascular and non-vascular plants, small mammals, and a diverse community of aquatic invertebrates, fish, and many bird species known to utilize other southern California wetlands. Enhancement of muted tidal wetlands or upland habitat, such as coastal sage scrub, grassland and saline seasonal marsh, does have benefits to fish and wildlife, but not to the extent that can be achieved with full tidal restoration. The SAC recognizes that upland habitat is important for functioning estuarine habitat and may be necessary to accommodate potential sea level rise in the future, and has given consideration to including such areas within the alternatives.

Alternatives 3, 4 and 5 create the largest areas of tidal estuarine habitat while Alternatives 1 and 2 have larger areas of upland and artificially muted tidal habitat (controlled by tide gates). Alternatives 4 and 5 create large areas of shallow subtidal habitat adjacent to mudflat. This would provide spawning and nursery habitat for pelagic and demersal fish species; these may disperse to the adjacent nearshore habitat and to other regional wetlands

2. Restore large, contiguous and diverse estuarine wetlands with subtidal habitat adjacent to mudflat and wide transitional habitat areas. Refined alternatives should include preservation and enhancement of some upland and freshwater wetland habitat but should emphasize contiguous estuarine wetland habitat. Opportunities to create regionally significant habitat including vernal pools and native grasslands should be pursued, but not at the expense of the restoration of estuarine habitat.

Alternatives with larger, contiguous, areas of diverse estuarine wetland habitat are more likely to sustain populations of associated species. Alternatives with fewer roads, wider transitions and more channels would have a higher quality of wetland habitat because they would be more remote from noise, lights, cars, and other human impacts. Alternatives with larger areas of contiguous wetland would also have fewer impacts from, and require less active management for, invasive plant and animal species.

Generally, the alternatives that restore more estuarine habitat have less area available for adjacent upland habitats or other regionally significant habitats. While upland habitats provide support to functioning estuarine habitat, there are opportunities for restoration of coastal sage scrub and bluff habitats in nearby offsite areas. Nevertheless, inclusion of some native upland habitat within the restoration project would be desirable.

Alternatives 3, 4 and 5 allow for the greatest range of elevation gradients and variation in topography. As such, these alternatives would allow for restoration of shallow subtidal habitat, intertidal channel, mudflats, low to high marsh, salt pans and transition zones. Alternative 4 would provide for the most

extensive subtidal habitat and associated adjacent mudflats. The gradients associated with these habitats would be particularly beneficial for numerous fish and bird species.

3. Restore fully tidal wetlands by removing or breaching levees to the extent possible.

The form of the tidal connection would affect the connectivity and function of habitat by influencing the movement of sediment, seeds, gases, nutrients, fish and fish larvae. Muted tidal systems, as in Alternatives 1 and 2, will have a reduced tidal range and therefore a compressed vertical range of habitats, limiting the area of transitional habitat that can be created. Fully tidal systems allow for greater tidal circulation and reduced residence time which will lead to a more rapid exchange of water with the ocean, and positive effects on exchange of gases, nutrients, fish larvae, sedimentation and improved water quality.

Tide gates do allow for control of water surface elevations within the wetlands but would limit connectivity with Ballona Creek and Marina del Rey, likely reducing wetland species diversity. Gates can also control pollutant loading, especially during storm events, although the muted tidal systems would have a longer residence time allowing greater settling of pollutants in the wetland.

Levee breaches proposed as part of Alternatives 3 and 4 allow for full tidal range, movement of larger fish and greater seed dispersal. Open breaches would allow greater tidal circulation, reduced residence times and would be able to adapt to rising sea levels. Levee removal in Alternative 5 has the advantages of breaches and increases the interaction between the wetlands and the Creek - creating gradients of inundation and salinity across the site, letting the morphology evolve and allowing for periodic disturbance by flooding and scouring. However, this alternative would require reliance on upstream flood control and pollutant removal, and could necessitate periodic removal of accumulated pollutants from some portions of the restored wetlands. Furthermore, it is unknown how the flow and sediment yield from the upper watershed would affect the sustainability of the marsh in terms of scour or sediment deposition.

4. Maximize hydrologic connections within the subareas and minimize potential water quality effects associated with influent

The higher quality sources of tidal water are the ocean and portions of Marina del Rey. The ability to bring this water into the wetlands would depend on the location of the tidal connection and the tidal excursion length. Alternatives 2, 3 and 4 improve tidal connections between Area A and higher quality water in portions of Marina del Rey; this would also benefit habitat connectivity for fish species. All alternatives have some connection to Ballona Creek, which, at present, has poorer water quality. Longer excursion lengths increase the mixing of water on each tidal cycle, improving water quality. Alternatives 3, 4 and 5, with the largest tidal prism, have excursion lengths extending to the ocean. The large intertidal areas of Alternative 2, 3 and 5 would have the shortest residence times, completely draining on most tidal cycles. As stated above, Alternative 5 would rely on upstream pollutant control measures to ensure water and sediment quality within the restored wetland.

5. Adaptive management measures should be incorporated into any restoration alternative

Alternative 1 has little change from the present situation and the risk associated with failed implementation is low. The restoration of wetlands in Alternative 2, 3 and 4 could be undertaken in distinct hydrologic areas which would allow for adaptive management and experimentation. Alternative 5 restores a large, contiguous area of habitat connecting a number of existing hydrologic units with Ballona Creek. This alternative makes the greatest change to the site, would be the hardest to reverse and consequently has the most risk. This risk may be mitigated to an extent by incorporating an adaptive management approach through phased implementation.

Open breaches would allow greater tidal circulation, reduced residence times and would be able to adapt to changing sea levels. Gates would require regular maintenance and management as failure could impact habitat and cause flooding. Fixed structures, such as gates and culverts, will need to accommodate both scour and sea level rise in their design.

SAC Recommendations

The SAC evaluated the ability of each alternative to achieve the ecosystem restoration goals of the project. This evaluation was based primarily on the expected physical and biological processes and habitat enhancement that would occur as a result of each restoration concept. SAC evaluation was not based on other project considerations of cost, logistics, or feasibility. These are critical issues for project design and implementation and will be evaluated by the Project Management Team during later phases of the project. Relative rankings of alternatives based on the analysis in the feasibility report, and summarized above are provided in Table 1.

The SAC recommends that Alternatives 4 and 5 be carried forward to the next phase of the analysis.

Alternative 5 would result in the greatest amount of contiguous wetland habitat and would have the least artificial structures or impediments. However, there are several unresolved issues associated with Alternative 5 that could affect its ability to provide sustainable, functioning wetland habitat. These issues would need to be addressed should it become a preferred alternative:

- Effect of erosive shear stress associated with high velocity storm flows on sustainability of the marsh plain
- Ability to manage potential adverse effects of pollutant input to the wetlands until such time as upstream management measures reduce watershed contaminant loading
- Ability to include additional upland habitat for both intrinsic value and as a buffer to the restored wetlands. For example, the Project Management Team could consider restoring Area C as primarily upland or transitional habitat.
- Lack of control structures to aid in accommodating sea level rise Refined analysis of potential flood elevations and associated implications for integrity of the restored wetland. This analysis

should include consideration of the need for new/additional flood protection measures if the Ballona Flood Channel levees are removed

- Ability to implement Alternative 5 in phases so that impacts to existing species and habitats can be minimized as restoration proceeds
- Although it would have lower internal connectivity and would retain more artificial structures, Alternative 4 would provide many of the same wetland functions as Alternative 5. Internal circulation and flushing would be lower than in Alternative 5, but Alternative 4 would provide more contiguous subtidal habitat and associated mudflats and transition zones. While Alternative 4 would reduce beneficial effects of flood inundation (e.g. temporary salinity reduction, nutrient influx), it would be less susceptible to the adverse effects of flooding, such as contaminant input. If Alternative 4 is carried forward as a preferred alternative, the subtidal area in Area A should be designed to be shallow enough to allow substantial turn over during a relatively few tidal cycles and should be reoriented to allow two tidal connections and gentle transition slopes.

The SAC also recommends that the following additional analyses be completed for both Alternatives 4 and 5:

- Potential effects of scour, sediment input, and deposition
- Potential effects of pollutant inputs (including trash and debris) and any necessary management measures
- Potential effects of sea level rise on long-term sustainability and/or adaptability of restored wetlands
- Potential ability of the restored wetland to support target species (to be defined in coordination with the SAC) as an additional measure of change in the final feasibility study. Each alternative should be evaluated for both the species that it would or would not be likely to support.
- Projected salinity and temperature regimes of Alternatives 4 and 5 to determine if defining estuarine transitions in these elements will be present (as opposed to primarily marine conditions). This analysis should also include the effect of potential salinity reduction and productivity-inducing effects of freshwater influxes.

Finally, whichever alternative is selected, it should be implemented in phases to allow mid-course corrections and re-evaluation of progress toward achieving project goals.

Table 1: Summary of Rankings of Alternatives Relative to Goals and Measures of Change

Subgoal	Measures of Change	Alt. Rankings		Rationale
		Lowest	Highest	
Habitat				
	area of tidal habitat	1	3, 4 & 5	Alternatives 3, 4, and 5 would each provide most of the site with unrestricted tidal access
	quality of estuarine habitat	1	4 & 5	Alternatives 4 and 5 would provide for the greatest amount of estuarine habitat with complex edge habitat, diversity of habitat types, and transitions between areas with varying tidal regimes
	habitat connectivity	1	5	Only Alternative 5 would provide for full internal site connectivity
	lack of impact to existing habitats	5	1 & 2	Alternative 5 would results in severe impacts to existing habitats
Biodiversity				
	number of wetland/aquatic plant and animal functional groups	1	4	Alternative 1 would likely result in the highest upland species diversity; however, Alternative 4 would likely have the highest wetland species diversity, partially due to the opportunity for mudflats that are contiguous to transitional habitats
	capacity to support sustainable populations of wetland dependent species	1	4 or 5	Alternatives 4 and 5 each have advantages in terms of sustainability. Alternative 5 has fewer artificial features, so maintenance may involve removal of sediment or trash or restoring scoured marsh vs. repair of structures. Additional analysis is necessary to determine the likely ability of each alternative to support target species.
Phys/Chem Processes				
	tidal circulation	1	5	Alternatives 3, 4, and 5 would all provide for full tidal access; however, circulation and mixing in Alternative 5 would be most like a "natural" system
	quality and reliability of source water	1	4 or 5	Circulation and flushing patterns in Alternatives 4 and 5 are both high; however, Alternative 4 provides greater ability to control pollutant inputs from the upstream watershed

stormwater and freshwater inputs	1	5	Only Alternative 5 would allow for stormwater and freshwater inputs that simulate "natural" conditions and are least restricted by infrastructure
biogeochemical cycling	1	4 & 5	Alternatives 4 and 5 would both provide a variety of habitats of various moisture regimes. The somewhat natural flow and circulation in Alternative 5 may favor some processes, while the longer residence time in Alternative 4 may favor others
sediment supply and quality	1 & 2	3 & 4	Alternatives 3 and 4 would provide for wetlands that are less susceptible to scour and deposition patterns from the upper watershed than Alternative 5
flood management	5	1	Alternative 1 would involve the lowest risk to infrastructure

Sustainability

sensitivity to sea level rise	3 & 4	1 & 2 (short term) 5 (long term)	Alternatives that maintain existing infrastructure would be most stable to a changing climate until the point were increased sea level overwhelms infrastructure. The unrestricted features of Alternative 5 could allow for more natural migration patterns than Alternatives 3 or 4 over the long term
resilience to episodic events	5	1	Alternative 5 would be susceptible to scour, pollutant spills, etc. that accompany floods, due to the unrestricted access to Ballona Creek
risk of terrestrial invasion	1	5	Restoration of wetland processes would create conditions more conducive to native vegetation outcompeting invasive species. Full tidal flushing would likely prevent persistence of any non-halophytic plants that might occasional invade. However, all alternatives would require ongoing control of invasive species.
risk of aquatic invasion	4 & 5	1	Alternatives that result in more subtidal area would be more susceptible to aquatic invasion (e.g., Japanese yellowfin goby, Asian date mussel).
intensity of maintenance needs	1	5	Alternative 5 would have the least infrastructure that would require maintenance, but could require substantial maintenance if impacted by a large watershed event (e.g. flood, scour). Alternative 5 design

and management features should allow for natural processes to compensate for periodic disturbance to the maximum extent possible.