San Francisco Bay Area Wetlands Restoration Program
Design Review Group

Letter of Review
February 11, 2004

National Park Service Big Lagoon Creek and Wetland Restoration
Muir Beach, California

IMPORTANT NOTICE: Please note that project review by the Design Review Group (DRG) does not constitute DRG endorsement of a project nor does it constitute a step in the regulatory and/or permitting process. Project proponents are free to pose questions to the DRG at their discretion and the DRG responds only to those questions deemed within its scope and realm of expertise. The Design Review Team does not intend to reach consensus in all of its feedback and dissenting opinions are included as expressed. All feedback is suggestive and non-obligatory; project proponents are not required to incorporate any or all of the feedback into their project design.

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1. Project Team:

a. Project Proponent(s): National Park Service (NPS) (represented by Project Co-Managers Carolyn Shoulders and Jennifer Vick)

b. Project Presenter to Design Review Group: Jennifer Vick (NPS)

2. Design Review Group and Design Review Team:

a. Dates Review Team met to discuss the project: The Design Review Group, including the Big Lagoon Wetland and Creek Restoration Design Review Team, featured the first presentation of the project on January 12, 2004. Following the presentation, the Team discussed the project and inquired about further information.

b. Non-Review Team Meeting Attendees: (01/12/04) Bob Batha (San Francisco Bay Conservation and Development Commission), Andree Breaux (San Francisco Bay Regional Water Quality Control Board), John Brosnan (Wetlands Restoration Program), Leslie Ferguson (San Francisco Regional Water Quality Control Board), Dale Hopkins (San Francisco Regional Water Quality Control Board), Linda Huller (Task Force on the Future of Mt. Tam/Muir Beach resident), Marla Lafer (San Francisco Regional Water Quality Control Board), Molly Martindale (U.S. Army Corps of Engineers), Mike Monroe (U.S. Environmental Protection Agency), Walter Postle (Task Force on the Future of Mt. Tam/Muir Beach resident), Michael Rochette (San Francisco Regional Water Quality Control Board), Barbara Salzman (Marin Audubon Society), Carolyn Shoulders (National Park Service), Stuart Siegel (Wetlands and Water Resources), Jennifer Vick (National Park Service)

c. Review Team: Peter Baye - Biology and restoration design (Independent biologist), Josh Collins - Geomorphology (San Francisco Estuary Institute), Laurel Collins - Fluvial geomorphology (Watershed Sciences), Phillip Lebednik - Ecology and wetlands function (LFR Levine-Fricke, Inc.), Roger Leventhal - Engineering and wetland hydrology/hydraulics (FarWest Engineering)

All five Design Review Team members were in attendance at the January 12, 2004 meeting.

d. Letter of Review's Editor: John Brosnan (San Francisco Bay Area Wetlands Restoration Program)

3. Review Process:

a. Assistance requested by project sponsor: Jennifer Vick, on behalf of the project's planning team, presented an overview of the proposed restoration project. In addition to general feedback on the project, Jennifer stated she sought Design Review Team input specifically on the following:

i. Based on the project's sediment budget dynamics, how will this site function from a physical standpoint

ii. As the project will lower the mouth of the creek and potentially excavate in current red-legged frog habitat, would/how would the future site provide the intended mix of habitats

b. Materials reviewed:

- Several planning documents obtained at the project's website, including:
  - Big Lagoon Environmental Assessment, April 1994. Prepared by Philip Williams and Associates.
  - Notice of Intent, Federal Register: December 3, 2002 (Volume 67, Number 232)
  - Sediment Budget for Redwood Creek Watershed, Marin County, California, August 2003. Prepared by Stillwater Scientists.
  - Big Lagoon Wetland and Creek Restoration Project: Part I, Site Analysis Report, September 26, 2003. Prepared by Philip Williams and Associates and Stillwater Scientists.
  - Big Lagoon Wetland and Creek Restoration Project: Part II, Feasibility Analysis Report, December 8, 2003 (Internal Draft - Not for distribution). Prepared by Philip Williams and Associates and Stillwater Scientists.
- *Preliminary Findings of the Big Lagoon Geoarchaeological Coring Program, Lower Redwood Creek, Marin County, California.* Jack Mayer, Staff Geoarchaeologist, Anthropological Studies Center, Sonoma State University, Rohnert Park, California, May 2003
- Project location maps and site aerial photographs (including a sequence of aerial photographs detailing evolution of the project site from the 1850s to today)
- Project presentation to DRG, January 12, 2004

- List of concerns and questions from the Muir Beach community, provided by Walter Postle (on behalf of the Task Force on the Future of Mt. Tam) at the January 12, 2004 meeting

c. Additional Information Requested by the Design Review Team: Design Review Team members did not request to review materials in addition to those documents and materials listed, above.

4. Design Review Team Findings and Comments:

The Design Review Team shared numerous comments and all feedback is captured in this section. The Team does not intend to reach consensus in all of its feedback and dissenting opinions are included as appropriate.

The following represents the professional opinions of the Design Review Team members. These opinions are provided for the benefit of the project proponent in direct response to those questions posed by the proponent. The project proponent is in no way obliged to incorporate any or all of the feedback herein into his project design.

a. Consistency with Habitat Goals:

The Big Lagoon Wetland and Creek Restoration project is located where the Redwood Creek watershed meets the Pacific Ocean. The geographic scope of the *Baylands Ecosystem Habitat Goals Report* does not include coastal locations west of the Golden Gate. In most instances, the DRG reviews projects within the geographic scope of the *Goals Report*, which is the same as the Wetlands Restoration Program's geographic scope. However, the Wetlands Restoration Program Coordinating Committee has provided guidance that has allowed the DRG to review projects in the coastal zone. The Committee stated the DRG may review a coastal project as long as there is no "bay" project (i.e., project located within the DRG geographic scope) awaiting DRG review, there is no cost to the Wetlands Restoration Program, and the program coordinator has the time to manage the Letter of Review (December 5, 2003, http://www.sfwetlands.ca.gov/120503.pdf).

Josh Collins, who participated in the Baylands Ecosystem Habitat Goals Project, shared the following: With regard to lagoon systems around San Francisco Bay, scientists working on the Goals Project discussed the need to restore all components to these systems as indicted by historical ecological study: barrier beaches and dune strands, open water environments, fringing flats and wetlands, and fluvial connections. It is generally recognized that a lagoon is variable in extent, depth, salinity, and even position or location due to dynamic interactions between fluvial discharge, terrestrial sediment input, breaches of dune systems and beaches, and sediment delivery from the marine side of the system. Such variability is natural and contributes to the overall ecological diversity of lagoons in time and space. However, such complexity is difficult to manage, particularly when management is focused on maximizing anything but diversity. Efforts to provide steady levels of recreation or to maximize certain wildlife populations or to provide flood control usually involve physical control of driving functions, such as sedimentation, fluvial hydrology, or tidal excursion. The conflicts between management objectives and natural hydro-geomorphic functions put

a premium on understanding the nature of the site and making sure objectives are achievable.

b. Issues Addressed by the Review Team, Discussion and Findings:

The Design Review Team providing feedback on all questions posed. That feedback is provided in aggregate, following General Comments, below, provided by the members of the Design Review Team.

General Comments:

Design Review Team feedback detailed under "General Comments" includes all team member feedback that specifically addressed issues other than the questions posed by the project proponent (see Desired Feedback, below). General Comments are organized by Design Review Team members' names, arranged alphabetically.

Peter Baye proposed a modification to Alternative 3, stating the alternative's lagoon emphasis should be on a larger seasonal backbarrier lagoon, rather than the "lagoons" (ponds) upstream in the riparian areas. He felt this change would likely reduce disposal needs. Overall, he suggested sacrificing some marsh space for an expanded lagoon basin letting the system evolve from there. Peter proposed restricting pedestrian access along the back of the barrier beach (the foredune zone), but restrictions were not necessary along the beach at the mouth.

Peter stated the seasonal wetlands between the recurrent stream mouth position (north end of Muir Beach) and the parking lot appear to have artificial fill over older sand deposits as a foundation. This is clear from the historic aerial photographs (pre-1960s) and the core data from the Meyer report. Excavation of a substantial portion of this area would encourage formation of an unstable, very dynamic backbarrier lagoon, with a variable channel configuration. Peter expected the system would alternate between supratidal beach, intertidal beach, tidal/fluvial channel mouth, and (barrier beach-impounded) lagoon, without consistent development of each type in all years. He noted this is uncomfortable for engineering a restoration design, but it is entirely appropriate and natural for the type of wetland system; the larger the excavated area, the greater potential lagoon wetland area may persist in any given year. Peter felt the existing habitat lost would be a mix of exotic-dominated wet meadow, native brackish seasonal marsh (*Juncus balticus/Potentilla anserina*) in transition to freshwater alter riparian thicket.

Peter also provided the following three technical comments:

The restoration plan assumes that the “lagoons” in Alternatives 3 and 4 would normally be brackish. Peter felt this is unlikely because storm surges that recharge salts when the mouth is open occur in winter, when vegetation is dormant, and relatively salt-insensitive. Winter flows would flush out most residual salts from overwash or surge events. During low-flow conditions, the barrier beach would either restrict (intertidal sill) or dam the mouth during spring tides, limiting saline incursions during the growing season. Larger lagoon basins, like Abbotts or Rodeo, or mouths that exhibit little tidal choking during spring tides, like

Pescadero Creek, are likely to maintain brackish marsh. Peter doubted willow or alder would be significantly restricted by root-zone salinity in the floodplain; they tap into permanent fresh groundwater. Willows may undergo cyclic dieback during droughts. Gravelly substrates with high groundwater may favor alders. Willows are more likely to be constrained by long periods of submergence during the growing season, especially in competition with sedges and bulrushes.

"Dune evolution areas" are unlikely at the north end of the beach in contemporary conditions. This is the upwind end of the beach, sheltered from dominant NW winds by the large headlands. Historic dunes were probably low hummocks formed by local deflation of washovers. The habitat priority for the north end should be backbarrier lagoon dynamics, not dunes. Dune "scrub" is also inappropriate: dune fore-grassland vegetation, mostly youthful foredune, would be most suited to transgressive barrier beach.

The tactic of using water depths to "control" tules and cattails, emulating managed marshes with water control structures, is probably infeasible and ineffective for the riparian ponds ("small lagoons"). Cattails and tules establish during drawdown periods (exposed mud). Once they develop clonal populations, they can tolerate limited periods of excessive submergence within the growing season (over a meter). Only deepwater conditions throughout the growing season, all years, would be able to confine their spread. This is not likely to occur under naturally variable rainfall and streamflow conditions. Occasional drought years may cause some cattail dieback. Competition with willow or alder may limit cattails. High nutrient levels (runoff from agricultural areas, residual pasture nutrients) strongly favor cattails in competition with other wetland plants.

Josh Collins suggested that the matter of "baseline condition" and the historical reference condition should be carefully reviewed with regard to the main objectives of project. It will be essential to predict within reason the minimum changes to channels needed to achieve the objective of flood control. Stream crossings are always a problem in the long term unless they are bridges that avoid the channel plus the flood-prone area.

With regard to reference condition, further examination of the earliest maps, especially the first Coast Survey topographic sheet dated 1853, is warranted to develop more understanding of the distribution and abundance of various habitat types, relative to each other and relative to the driving hydrological and geomorphic processes. Josh stated these processes might be classified along a gradient between terrestrial/fluvial conditions in the valley to marine/tidal conditions at the beach. He also suggested the Stillwater, Meyer, and other reports that speak to upstream processes through time ought to be used to develop a "watershed view" of the transitional region and its lagoon. Josh suggested that throughout the analysis of historical processes and conditions it should be noted, as clearly indicated by the Meyer report on local geoarchaeology, that the whole watershed including the lagoon and coastal beach underwent substantial changes in sedimentary regime prior to Euro American contact, with the various habitat types shifting up-valley and down, even during the last few centuries, as the relative influence of fluvial versus tidal processes changed. This indicates the need to plan for such changes in the future.

Based on his review of the historical materials for this lagoon and others, Josh presented a new interpretation of the Coast Survey map. He does not see a continuous, single–thread main stem channel extending down the valley and into the lagoon. By looking at the map as a whole, he concludes that the main creek channel was discontinuous along the lower valley bottom above the lagoon, and that channels to the main creek did not always connect the tributaries. The landscape consisted of a main stem channel dissipating into a wet meadow system about half way down the valley, and then re-emerging near the head of the lagoon. He added trees (probably willows) shown on the 1853 map might mark the wettest parts of the meadow, including where the stream enters and emerges. The tributaries have similar conditions, where the channels dissipate into wet meadows or "slope wetlands" before they reach the main valley bottom. The low gradient of the valley and its stream, and a very high water table, would be expected due to the elevated hydrological base level caused by the rising stand of the sea. In essence, the valley has been filling behind sea level. Josh added that when sea level was lower, the stream gradient near the area that, at the time of the Coast Survey, was the head of the lagoon, was steeper, had more power to move sediment, and built natural fluvial levees atop its banks. As sea level rose, the stream gradient flattened, and the fluvial system was drowned. But the higher levees remained above the surface of the full lagoon. In other words, the levees shown extending into the lagoon by the first Coast Survey represent remnants of a drowned fluvial drainage system, and not levees that have been built into the lagoon. As sea level rose, the wet meadows and marine/tidal systems crept up the valley. Josh added that this process will continue, given that sea level is still rising.

Josh noted that the archaeological surveys indicate substantial human occupation of this lagoon setting for at least 2000 years, ending in the 19th century. The first Coast Survey shows major trails leading to and from the immediate vicinities of known Miwok habitat sites. Josh felt the possibility that local Miwok managed the lagoon to some extent (e.g., breaches opened and closed; fluvial channels maintained, etc) couldn't be ignored. The Coast Survey map may be a picture of an abandoned landscape, adjusting to the cessation of indigenous management and not yet subject to intensive Euro American management. Josh felt it would be interesting to know the extent to which the lagoon shown in the 1853 map, and the associated array of habitat types along the valley, were due to previous indigenous land management, since these may be the same kinds of practices that the NPS would want to employ.

Josh expected that, except during major flood events or when hillsides failed, much of the fluvial sediment was being trapped in the wet meadow and on the wet tributary fans, and not reaching the lagoon, and that the sedimentary records reported by Meyer support this interpretation. Josh felt the lack of sediment input probably accounted for the lagoon's persistence.

Josh noted that that project as described in the supporting materials was really driven by the need to protect neighbors from flooding. He also recognized that the various alternative approaches to flood control all involve improving drainage (i.e. moving surface water faster down-valley past the neighbors) and dealing with the large sediment supply provided by natural processes and human operations upstream in the attending watersheds. Drainage is addressed by re-routing the main creek from a man-made ditch peripheral to the valley to a

more natural channel near the valley centerline. Problems of sedimentation are addressed by creating a hole (lagoon) into which the sediment can flow and be stored. Various ecological and recreational tradeoffs accompany the alternatives.

Josh deferred to others to assure that the alignment, planform, and size of the new channel are adequate for self-maintenance, both in terms of discharge and sediment transport. But he suggested that any plan to move sediment and store it at the bottom of the system would fail to create a lasting lagoon. He felt it would simply fill with sediment and have to be dredged. Many unplanned habitat changes can accompany the process of filling the lagoon.

Josh suggested that, in the short term, the channel be moved into the valley bottom and extended more efficiently across the beach strand, to help solve the flooding problem (he noted that most maps show the breach on the north end of the beach, which is the case for most lagoons along this part of the coast). He felt relocation of the staging area could be an integral aspect of the creek re-alignment, as already planned, but the problem of sedimentation should be addressed at the watershed scale.

At the watershed scale, Josh felt a long-term plan of restoring wet meadows with high water tables by decreasing channel density and restoring alluvial fans (or analogous functional features) should be explored. This would minimize sediment transport into the intertidal zone or lagoon setting, help prevent channel aggradation near the flood hazards. It would certainly benefit some target wildlife species (e.g., red-legged frogs and riparian birds), and enable the creation of a long-lasting lagoon at the valley bottom. Whether or not anadromous fish will pass through wet meadows or willow thickets during flood flows will need to be answered, but the historical data suggest they did, or this watershed lacked anadromous fish. Josh fears that unless the sediment problem is addressed upstream from the lagoon and upstream of the flood hazards, the problem will persist, and effort to control flooding and to restore habitats will have to involve the expensive maintenance of sediment catch basins, even if they have transitory functions as lagoons.

Josh recommended that all restoration and flood control plans should address the reality of sea level rise and transgression of the marine environment into the valley and its creek.

Laurel Collins asked about the period of time that was used to establish the current sediment supply conditions and why that particular bracket of years was chosen. Laurel suggested that basing assumptions on the creek conditions in the most recent timeframe, from 1981 – present, would skew the budget to particularly high rates because the 1982 storm was the largest storm of the century and the following years have had higher than normal rainfall. She noted it was possible that heavy rainfall from the 1982 events could have "reset" the system. She pointed out that had some of the years prior to 1982 also been used to establish the current conditions, lower sedimentation rates would serve as the baseline. She asked, how much impact did the parking lot, alone, have on sediment deposition? Laurel suggested that modification of the No Action Alternative should be considered where there would be an elevated bridge across the creek and floodprone portion of the valley, and a substantial reduction in parking lot size (or even elevation of the parking lot on piers). Such modification might dramatically reduce sedimentation rates and would avoid modification of the streambed. Laurel then referred back to the Feasibility

Analysis and proposed that some of the tributaries to the main stem of Redwood Creek were previously disconnected by alluvial fans and that the main stem could have been periodically disconnected from its ocean outlet. She suggested that Coho could have migrated up this system during flood events. She stated that even though the opportunities for fish passage may have historically been more limiting, the natural system functioned sufficiently to provide viable habitat. She asked if some consideration could be given to disconnecting some of the tributaries by designing alluvial fans. In this way downstream sediment transport and peak flooding would diminish and summer base flow would increase. Using fill from the parking lot could be used to help reconstruct an alluvial fan and provide for an adequate disposal site.

Laurel questioned if consideration had been given in future scenario planning as to how sudden oak death and accompanying increases in woody debris and sediment storage might influence the project? She also questioned whether or not Green Gulch Farms would always maintain their reservoirs and, if they didn't, how the project area might be affected. Under some of the proposed alternatives, Laurel questioned if inundation of the alders in the valley might greatly impair their survival. She suggested that the relationship of alders to the groundwater table should be more thoroughly considered in the various alternatives.

Phil Lebednik noted that the project planning emphasized a great deal of upstream evaluation and wanted to make sure the planning team sufficiently recognized the role of coastal littoral processes. Phil suggested investigating the creek functions that are connected to the littoral processes, as it is that interaction that controls the channel's opening and closing. He added this is a particularly important relationship, as it will greatly impact the local Coho populations. Phil advocated for restricting public access to the dune areas, noting their high sensitivity to perturbation. Phil cited the potential for western snowy plovers to use this site in the future. He advised the project team to control for invasive species. Phil questioned the effects of constructing a new channel behind the dunes and also questioned how dunes could be created east of such a channel, because littoral processes may not be sufficiently connected to sustain them. He noted that Alternatives 2 and 3 do not replicate the historic thalweg gradient while alternative 4 does and asked why 2 and 3 do not. He suggested that all alternatives replicate the historic thalweg gradient, unless detailed analysis indicated that a different gradient is a viable restoration option.

Roger Leventhal asked, what is known about the sediment particle sizes from the upper to the lower watershed (especially the D94 and D50)? He added that, depending on the sediment sizes and channel shear forces, Alternative 2 might not be stable. He noted that the design does not appear to be geomorphically based and that none of the provided reports show typical geomorphic design approaches such as reference site work or field indicators. He noted the report mentions that the creek depth is 5 ft and therefore at this flow depth the channel shear forces will likely be high and could potentially over-erode the banks of the river and suggested beginning with a geomorphic basis. Knowing the sediment particle size distribution and changes down the watershed gradient was essential in determining the stability of the proposed channel design concepts. He asked if the Green Gulch tributary was included in the modeling flow and stated a 2-D model might be more applicable to the proposed project in the tidally influenced pond areas. He asked, will there be adequate flow to move fluvial sediments with the planned 3% grade? He also stated that

if the parking lot needs to remain then its possible that flood flows could be directed into culverts placed underneath the parking lot surface as opposed to an impermeable fill that blocks flows.

Desired Feedback:

The Desired Feedback consisted of those issues on which the National Park Service planning team sought specific Design Review Team comments and recommendations. These topics were:

i. Based on the project's sediment budget dynamics, how will this site function from a physical standpoint?

Peter Baye noted how this system is currently storing fine sand in artificially enlarged dune blowouts (maintained by trampling in the proper foredune zone) that migrate landward, making fine sand less available to the littoral cell. He speculated that dune deposition patterns severely modified by long-term trampling might constrain beach sand supply and processes that affect seasonal lagoon formation.

In terms of "lagoon" versus "riparian backwater pond and marsh" in the restoration design, Peter felt the restoration plan seems to equivocate somewhat on the nature of the historic and restored "lagoons". He stated the restoration design focuses on fluvial processes and riparian habitats, and understates the relationship between littoral (beach and dune) processes that influence dynamic seasonal lagoon formation. Peter noted the "lagoons" in the design seem to be predominantly riparian features, backwater ponds embedded within a floodplain; the large and smaller "lagoon" alternatives seem to function much like sediment detention basins that progressively accumulate sediment, but lack natural erosional processes for self-maintenance. They contrast in position and configuration with typical modern seasonal backbarrier lagoons associated with small stream mouths (scale similar to Muir Beach) in central and northern California.

Peter continued: True stream-mouth lagoons are natural impoundments (beach-dammed ponds) formed over channel mouth beds or seasonal marshes, submerged when the stream mouth (tidal inlet) chokes with sand. Mouth closure may be partial, developing either intertidal sills (flood tidal-dominant, stream discharge at low tide, shallow impoundment), or complete closure by beach ridges (elevations above spring tides). Mouths closed by beach ridges allow lagoon/stream discharge as seepage, proportional with grain size. Closed barriers actually enable lagoon water surfaces and groundwater to elevate above sea level (due to wave set-up: Jackson et al. 1999, Estuaries 22: 753-762). The annual submergence cycle of seasonal lagoons are typically the reverse of precipitation-driven or fluvial seasonal wetlands: lagoons are often most drained during high-outflow conditions, when the mouth is open, and most flooded in the dry season, when the mouth is closed by beach accretion. Riparian

(backwater) ponds, in contrast, typically behave like seasonal wetlands, with hydroperiods and depths corresponding with rainfall and stream discharge.

Seasonal stream-mouth lagoons are also capable of self-maintenance by intense periodic (often annual) erosion of the mouth. Intense erosion of the lagoon area (channel bed, adjacent wetlands) near the mouth may occur during extreme high discharge periods (channel incision, meandering), or when breaches occur at low tides when the lagoon water surface elevation is high, causing intense, brief erosion. Storm wave erosion may also enlarge lagoons, attacking marsh edges when sheltering barrier beaches are eroded. In contrast, backwater riparian ponds and marshes tend to accrete progressively between infrequent extreme erosional flood events.

Peter noted two types of ponded features, seasonal backbarrier lagoons and floodplain backwater ponds, should be compatible within an overall restoration design, and need not compete with one another (except in sediment disposal requirements). Seasonal backbarrier lagoons are intermittent estuaries, and have particular importance for salmonid smolts. Relatively stable portions of lagoons (not annually buried by sand) may also provide potential habitat for episodic, unpredictable recolonization by tidewater goby or *Ruppia maritima*, a common form of submerged aquatic vegetation valuable for fish habitat, typical of stream-mouth lagoons in the region. Riparian ponds and marsh, in contrast, may have higher habitat values for California red-legged frogs. Including both lagoon and backwater pond habitats in the restoration design may reduce trade-offs (habitat restoration antagonism) among target species.

Peter agreed with the Meyer report's assessment of the prehistoric condition (restoration model in part) of Big Lagoon, based on stratigraphic data: "estuarine deposits...complicated by occasional blockages of the lagoon outlet due to sand bars and/or dune migration", including local channel deposits from occasional high-energy fluvial conditions. This is consistent with many congruent features in the 1853 USCS map that Josh Collins and Peter agree are highly suggestive of a (seasonally) "drowned marsh", impounded by a sand-choked stream-mouth.

Laurel Collins referred to the creek channel location in Alternative 3. She suggested there was insufficient room for the creek's lateral movement between the lagoons without eventually migrating into one of them. Laurel suggested that the configuration does not produce a natural sustaining environment as stated in the desired objectives. She also agreed with Phil on the point that the parking lot location doesn't limit bottlenecking of the new channel. Laurel questioned the assumption in Alternative 4 that the lagoon will have enough flow to keep the mouth open if sediment would be continually filling it up. She suggested investigating other similar sized coastal watersheds of this type for examples of their historic conditions and of existing restoration projects. Watersheds could include San Pedro in Pacifica, which has a restoration project at its ocean outlet, and Muddy Hollow in Pt. Reyes, which is similar in drainage area. She proposed that perhaps Coho and steelhead could navigate past willow

and alder growth in narrow distributary channels, but that the alder forests in the Pacifica and Muddy Hollow watersheds resulted from high sedimentation rates caused by agricultural land use practices.

Laurel noted that the floodprone width in Alternative 2 is still somewhat constricted by the parking lot and that accelerated rates of sedimentation upstream will likely continue with the proposed configuration. She pointed out, however, that the rate of sedimentation for future filling in Alternative 2 is based upon the rate with the existing parking lot configuration, which Laurel suggested has clearly contributed to increased deposition; she suggested the rate of deposition for the proposed future scenario should probably be lower (although still accelerated) because the flood prone area would be less constricted than its present configuration. Laurel suggested that if the lower parking area was removed, it could be turned into a deep pond for enhancing habitat for salmonid out-migration.

Phil Lebednik advised a better understanding of how this project could affect (more likely be affected by) the dynamic processes going on at the site. He stressed that developing an appropriate and self-sustaining restoration project begins with an understanding of both the littoral and fluvial processes. He noted the dynamic foreshore environment has a periodic but critical influence on the backshore dunes, ponds and wetlands. In turn, the physical natures of those habitats dictate not only their habitat value but also system responses when the beach outlet is open. As a practical matter, Phil felt it might not be possible to develop a complete understanding of all littoral processes prior to project initiation. He felt a viable option would be to phase the project over a period of years to test the system's response to certain initial physical alterations and that adaptive management could be used to modify subsequent phase plans based on the responses to preceding phases.

ii. <u>As the project will lower the mouth of the creek and potentially excavate in current red-legged frog habitat, would/how would the future site provide the intended mix of habitats?</u>

Peter Baye felt there might have been some lost opportunities in not more deeply investigating the littoral processes that maintain the seasonal lagoon during low fluvial discharge conditions. He referred to the 1853 photo and what could have been the low tide line at the mouth, stating the system in its 1853 state might have been a drowned marsh impounded by a naturally beach-choked stream mouth. He felt the restoration was being driven by the fluvial design (backwater riparian ponds as "lagoons"), which inherently has different properties from a coastal backbarrier lagoon. Peter suggested separating the designs for coastal backbarrier lagoon and riparian marsh plains. He felt it would be hard to build a pond over the channel (like a sediment detention basin) and not have it quickly fill in with sediment, yet he noted the backbarrier lagoon periodically scours out from high flows or storm erosion. He suggested exploring the option of

excavating (enlarging) a backbarrier lagoon by removing past fills and storm deposits between the parking lot and the mouth.

Peter referred to the project map and stated there was not high potential for dunes on the parcels northwest side (because of sheltered position in relation to dominant NW winds and sand deflation sources), where the design called for a "dune evolution area". He noted that sufficient fine-grained summer sand at the lagoon channel's mouth would choke the mouth enough to impound the lagoon seasonally.

Peter felt the best restoration opportunities for Coho were at the downstream end of the project, in the seasonal backbarrier lagoon.

Phil Lebednik asked if some of the structures associated with other project goals (e.g., bridge replacement, parking, viewing pads, etc.) could be incorporated into the creek realignment and restoration plan to create channel meander, which would benefit Coho. Phil suggested that a creative conceptual design could be developed that enhances habitat value, accommodates natural processes and includes several project components. He added, by siting and constructing infrastructure such as parking lots, viewing areas, and bridges at appropriate alternating locations, creek meander could be facilitated which would also enhance wetland area and diversity. This approach takes a potential challenge (bottlenecking of the creek) and turns it into an enhancement opportunity. Inclusion of designed limited floodplain areas interspersed with infrastructure, together with increased bank length, could result in an increase in frog habitat. If this design could be implemented, significant wetland habitat could be obtained. Downstream, nearer the littoral portion of the site, geometry and vegetation should enhance viable rearing habitat by limiting high water temperatures or providing refuges from such. He asked, why build lagoons if they are expected to silt in? Phil noted the Coho and steelhead here are part of the Central California Coast Evolutionarily Significant Unit (ESU) and recommended that assisting the recovery of these species should be prioritized because there are limited sites where Coho restoration can be done, and even fewer places where there are extant Coho runs as there are here. He noted that viable outmigrant habitat might be a factor limiting stock (total Coho population size in the creek) and recommended that the restoration design incorporate consideration of viable outmigrant rearing habitat and appropriate features for upstream migration of adults (including pools and other low velocity habitats to facilitate resting).

Referring specifically to relationship between dune management and backbarrier lagoon restoration, Peter noted an indirect but important relationship between dune management and lagoon restoration. He noted the restoration plan identifies one direct relationship, in which dune accretion may choke the channel mouth at times. Peter felt a potentially more important indirect relationship may have to do with the sand budget of the littoral cell in the fine-medium grain size range. The foreshore around the mouth in summer accretes relatively fine sand, and most of the beach sand involved in the morphodynamics of mouth closure

and tidal choking of the lagoon depends on fine sand, during calm periods of refracted swell. Coarse sand is associated with the high-energy winter beach, when the mouth is open. Decades of intensive recreational use of the beach has effectively devegetated the backshore zone that would naturally develop foredunes that trap a significant portion of the annual onshore wind-transported sand load. Peter referred to evidence of long-term loss of fine sand from the littoral cell, due to exaggerated accretion of backdunes along trampling-maintained blowouts at the south end of the beach (downwind of dominant NW winds); the foredune zone is instead maintained as a permanent deflation zone by trampling (devegetation) and the site of dune accretion is well landward along the base of the hillslopes. Peter stated these relatively large volumes of fine sand are unavailable for "recycling" to the littoral cell by storm wave erosion, or even channel migration. This could result in some constraint (sediment deficits within the fine sand particle size class) on beach accretion and lagoon impoundment at the mouth in summer: it could delay, or limit the height, of the barrier beach ridge, reducing seasonal lagoon formation.

From the historic aerial photo series, Peter felt that, at least in some years, sufficient sand is available for beach-dams to close the mouth and sometimes even fill the lagoon with sand. In other (recent) years, he has observed only intertidal sills that partially dam the mouth in summer, forming a very shallow lagoon with minimal fish habitat.

Peter felt that maintaining at least minimal foredune vegetation along the back of the beach would potentially contribute to greater retention of fine sand in the littoral cell, where it would be available for beach accretion near the mouth and, thus, lagoon formation. He stated the lack of foredune vegetation along the back of the beach has also caused low dunes to transgress directly over marsh and alder thicket; establishing native dune-forming plants, especially clonal grasses, would also help inhibit artificially exaggerated transgression of wetlands by blowing sand. Peter noted three species in the genus *Leymus* are commonly found on beaches with high groundwater around Point Reyes: *Leymus mollis*, Pacific dunegrass (present at Muir Beach), its natural hybrid with *L. triticoides*, *L. xvancouveriensis* (dominant on beaches of Tomales Bay), and the alluvial *L. triticoides* (present at Muir Beach on backdunes). He added reducing the size of the fan-shaped deflation zone at the south end of Muir Beach could be achieved by installing a mobile boardwalk or an extended and wider elevated boardwalk.

c. Issues Not Addressed by the Review Team and Rationale:

The Design Review Team did not decline to respond to any questions posed during or following the project presentation.

d. Phasing and Coordination:

e. Other issues:

5. Disclaimers:

a. The recommendations of the Restoration Program are not binding on any permitting agency and they will not restrict any agency's authority.

b. The Wetlands Restoration Program's Design Review Group makes every effort to provide guidance; we cannot guarantee issuance of permits by any regulatory agency.

c. The Wetlands Restoration Program's Design Review Group is intended to provide comments and feedback on plans and designs. This assistance will necessarily be limited, and should not be expected to substitute for professionally prepared site evaluations, hydrological studies, final designs, and construction plans.

d. The Restoration Program and the participating agencies will not be liable for the failure of any project.

e. Project review by the Design Review Group does not constitute an endorsement of the project by the Design Review Group or by the Wetlands Restoration Program.

6. References

Jackson, N.L., D.P. Horn, V. Spalding, and K.F. Nordstrom. 1999. Changes in beach water table elevation during neap and spring tides on a sandy estuarine beach, Delaware Bay, New Jersey. Estuaries 22: 753-762.

ATTACHMENT A

PROJECT DESCRIPTION

i. Project objectives:

The stated project goals include the following: restore a functional, self-sustaining ecosystem; develop a restoration design that functions in the context of the watershed and the region; recreate habitats for special status species; reduce flooding on Pacific Way and in the Muir Beach community; provide visitor experience and public access that are compatible with the ecosystem restoration and historic preservation; incorporate Federated Indians of the Graton Rancheria cultural values and indigenous archeological resources into the project; provide opportunities for public education and community-based restoration; and, coordinate with the Comprehensive Transportation Management Plan to identify transportation alternatives that are consistent with ecosystem restoration. The stated strategy for achieving the project's goals includes recognizing the site is a dynamically evolving system, grading the site template to anticipate and to take advantage of geomorphic processes, designing the template to achieve desired habitat characteristics as the site evolves, accommodating future sediment delivery and minimizing maintenance and intervention.

Alternative 1 is the No Action alternative, Alternative 2 focuses on creek restoration, Alternative 3 focuses on creek and relatively smaller lagoon restoration and Alternative 4 would restore a very large lagoon. The parking lot's new design and configuration would be based on what is hydrologically appropriate for the site, in each of the action alternatives. Parking in close proximity to the beach would be retained in Alternatives 2 and 3, while Alternative 4 would concentrate the majority of the parking near Highway 1 (which poses a higher potential for traffic and safety impacts). Jennifer stated Alternative 3 presents the best mix of open water and riparian habitats at 50 years out from construction.

Excavation costs present the highest cost of the project. Sediment volumes increase from 10,500 to 100,000 to 170,000 cubic yards from Alternative 2 to 3 to 4. Associated projected costs of moving that sediment off-site increase at a similar rate. Sediment removal options considered but were deemed infeasible include piping sediment offshore, barging it (which would require a slurrying facility). Trucks will most likely be used to remove sediments and NPS has identified potential off-site disposal locations.

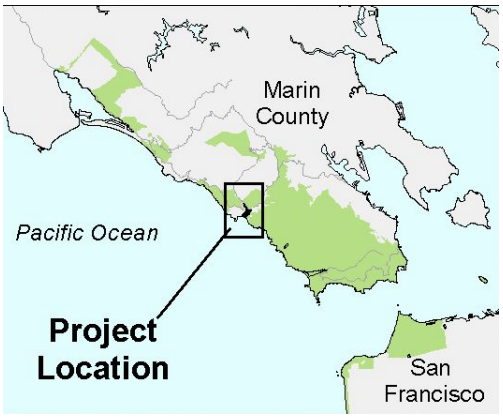
Key findings include: Alternative 2 is anticipated to be a stable equilibrium form with little change in habitat types over the planning horizon; Alternative 3 small lagoons would be mostly filled by Year 50, converting open water areas to wetlands; Alternative 4 Large Lagoon would be about half filled by Year 50; Alternative 2 provides the most acreage of riparian woodlands, but the least wetland habitat; Alternative 3 would maintain the largest mix of open water, wetland, and riparian habitat types; Alternative 4 would sustain the highest proportion of estuarine habitats compared to other alternatives; Winter rearing habitat and passage for salmonids will be improved under Alts 2 – 4; Greater flow depths, channel complexity, and floodplain connectivity; Alt 3 provides greatest benefit followed by

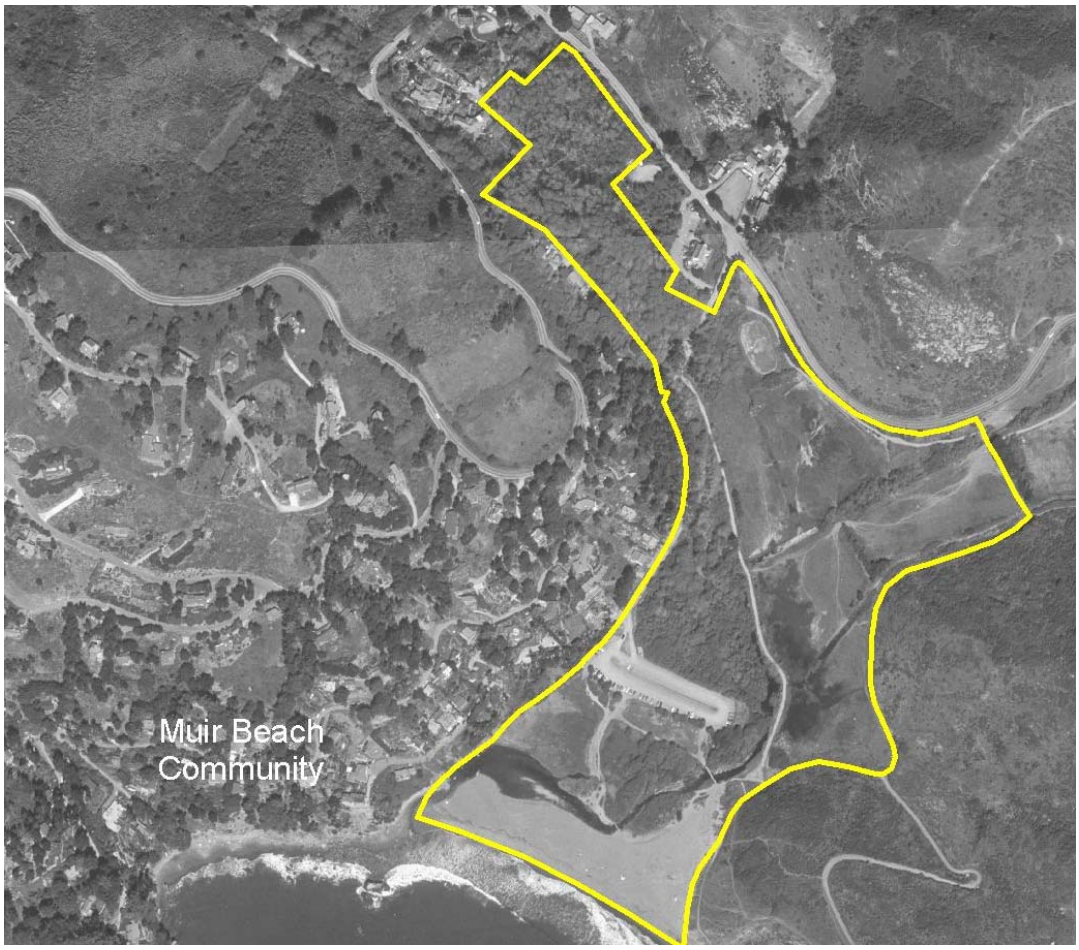
2 & 4; Breeding and rearing habitat for red-legged frog will be improved under Alts 2 – 4, initially, Alt 2 provides greatest benefit; Bird diversity is expected to improve under Alts 2 – 4, Alt 3 will promote greatest bird diversity; No Action Alternative would likely result in increased flooding, significant annual maintenance, and potential loss of fish passage; Alternative 4 would provide the greatest improvement to flooding and Alternatives 2 and 3 also provide improvement relative to No Action; Public access, parking, and trails can be accommodated by the restoration alternatives; and, onsite or offsite disposal of excavated material is a key feasibility and cost issue.

ii. Project location and map:

The Big Lagoon Wetland and Creek Restoration is located in the community of Muir Beach in southwest Marin County (see Figure 1, next page). Redwood Creek flows through the site and is periodically connected to the Pacific Ocean. The majority of the watershed is under public ownership. The project site is about 40 acres in size and land ownership is split between the National Park Service and the Green Gulch Farm, which is private property.

FIGURE 1





Images obtained from NPS PowerPoint presentation of January 12, 2004

iii. Type and acreage of habitats to be created or restored:

Alternatives 2, 3 and 4 would create a mix of habitats on the 40-acre site, which would include open water lagoon, seasonal wetlands and riparian/creek habitat.

iv. Past use and current condition of the site:

An aerial photograph of the site from 1853 shows about 12 acres of open water on the site along with 13 acres of wetlands.

In general, the site contains creek channels, willow-alder riparian habitat, seasonal wetlands, sand dunes and coastal beach. The site is breeding habitat for the endangered California red-legged frog (frogs are breeding on the Green Gulch property) and rearing habitat to Coho salmon and steelhead. The site has supported Western pond turtle in the past. The Coho do not stay at the site due to chronically depressed dissolved oxygen levels. Approximately 440,000 people visit the site annually and 94% of those visitors arrive by private vehicle. The site includes extensive hiking, horse riding and biking trails. Cultural (midden) resources have been located at the site.

Since 1997, the Redwood Creek channel has been expanding and associated sedimentation problems have been worsening. A positive feedback cycle of sedimentation has been emerging, as high sediment loads associated with storms and landslides have flushed down the creek to choke off the creek mouth. The groundwater table's rate of rising has only increased along with this sediment deposition. At some points along the creek, the creek's thalweg is higher than the valley floor. This has contributed to flooding over Pacific Way and the access road and some private homes have been flooded. The levee road is quickly deteriorating due to flood flows over its surface. Different entities, including the National Park Service, Marin Municipal Water District and the ~150 homes in the community of Muir Beach, have water rights along Redwood Creek. It is expected that the proposed project's lowering the mouth of the creek (near the present parking lot) will lower the groundwater, which is one concern for water rights holders. The Muir Beach supply is located one mile upstream from the proposed project site.

The creek channel does not currently provide spawning habitat for salmonids, but juvenile Coho and steelhead are found in the backwater through summer. The Green Gulch tributary maintains limited rearing habitat. Seasonal wetlands along the east side of the project site provide breeding and rearing habitat for red-legged frog, western toad, Pacific treefrog, California newt and the rough-skinned newt. Threespine stickleback and Sacramento blackfish use the flooded pasture and channels, as do wintering waterfowl and shorebirds. The tidal lagoon provides steelhead summer rearing, rearing or refugia for Coho, and habitat for Yellowfin goby, starry flounder, staghorn and prickly sculpins.

v. Description of any special features or issues:

a) Public access

Public use of the proposed project site is extensive. The site includes a large parking lot and extensive hiking, horse riding and biking trails. Approximately 440,000 people visit the site annually and 94% of those visitors arrive by private vehicle.

b) Flood control

Pacific Way (the beach access road and ingress/egress for local residences) is situated in the floodplain and regularly floods during heavy storm events. Redwood Creek has been confined between Pacific Way and the adjacent levee road, which has resulted in localized channelization. Willows and alders have colonized locales of excessive sediment deposition. A current hypothesis purports channelization has filled in the lagoon. Some private homes have been flooded and the levee road is quickly deteriorating due to flood flows over its surface. Addressing and minimizing flooding impacts is a driving force in this project's planning.

c) Subsidence

Subsidence is not a critical concern at the proposed project site.

d) Mitigation

Mitigation is not a component of the proposed project.

e) Other adjacent/nearby projects

There are no wetland restoration projects occurring in the immediate vicinity.

f) Opportunity for transitional habitats

The project currently maintains a mosaic of habitats, including coastal lagoon, riparian, seasonal wetlands, sand dunes and uplands. Each of the action alternatives includes different proportions of these habitats.

g) Other issues

Different entities, including the National Park Service, Marin Municipal Water District and the ~150 homes in the community of Muir Beach, have water rights along Redwood Creek. It is expected that the proposed project's lowering the mouth of the creek (near the present parking lot) will lower the groundwater, which is one concern for water rights holders.

ATTACHMENT B

San Francisco Bay Area Wetlands Restoration Program Design Review Group Conflict of Interest Statement

The San Francisco Bay Area Wetlands Restoration Program Design Review Group (the Group) attempts to have those reviewers who participate as members of the Group avoid any conflict of interest. Conflict of interest, as it relates to the Group, is distinguished into two categories: financial and personal/institutional. The two distinct types of conflict of interest warrant two distinct courses of action of the part of each Group member. All those members having a *financial* conflict of interest with a project will NOT be allowed to evaluate proposals for which they have a financial connection and/or provide guidance and comment on that project, without exception. However, those Group members having a *personal/institutional* conflict of interest are required only to disclose any relationship, yet are not disallowed from project review and comment.

Regardless of the type of conflict of interest, each Group member has the personal obligation to avoid a conflict as well as the personal obligation to disclose any such conflict, whether real or apparent, to the Group as a whole.

Financial Conflict of Interest. The Wetlands Restoration Program expects that Group members will not review proposals in whose development they have assisted or if they would receive a financial benefit from the funded project. A conflict of interest would be considered to exist whenever a member of the Group **or** a relative of a Group member (including, for instance, a spouse, sibling, parent or child) has a personal, material, or financial interest in a transaction or project under consideration by the Group.

Personal/Institutional Conflict of Interest. If a Group member has a personal or institutional connection with a project sponsor in any way, but there is no conflict of interest, the member will be allowed to participate in the project review provided that any connection is disclosed prior to project review. A personal connection with a project sponsor is considered worthy of disclosure if any of the following relationships were applicable during the **past four years**: collaboration on research, pilot, or implementation proposal or project; co-authorship; thesis or postdoctoral advisorship; and/or supervisor/employee relationship. An institutional connection – such as between employers and their employees – will be considered worthy of disclosure. For example, an employee of a state or federal agency is considered to have an institutional connection with a proposal submitted by that agency, even if the project sponsor is in a different division of the agency than the reviewing Group member. Similarly, a university faculty member is considered to have an institutional connection with a proposal submitted by that university, even if the applicant is in a different department of that university campus.

To avoid any problems with conflict of interest or appearance of bias, scientific and technical reviewers are expected to review proposals independently and without delegating the review task in whole or in part to any other person. Any efforts to delegate review will be considered a conflict of interest. If you are uncertain about a potential conflict of interest, please contact John Brosnan at (510) 622-5048.