Adaptive Management Summary Table—Sediment Dynamics and Marsh Development Group

Category	Restoration Target	Monitoring Parameter (Method)	Spatial Scale for Monitoring Results	Expected Time frame for Decision-making	Management Trigger	Applied Studies	Potential Management Action
Sediment Dynamics Project Objective 1 (Preserve existing estuarine habitat areas)	No significant decrease in South Bay intertidal and subtidal habitats (south of San Bruno shoal), including restored pond mudflat, intertidal mudflat, subtidal shallow and subtidal channel areas.	* Area of restored mudflat. * Area of outboard mudflat. * Area of subtidal shallows and channel. Methods: Bathymetry and LiDAR surveys will be performed periodically, initially every 3-5 years and then less frequently if data suggest slower rates of changes over time.	* Change in tidal mudflat and subtidal shallows expected to vary at the pond complex scales. Areas will be estimated and reported on the pond complex scale. * Changes in South Bay need to be placed within system-wide (San Francisco Estuary) context to assess influence of external factors.	* Change in tidal mudflat & subtidal shallow: 10-20 years, assuming significant tidal habitat restoration continues beyond Phase 1. * Subtidal channel change: 0-5 years.	* Outboard mudflat decreases greater than the range of natural variability + observational variability/error.	* Will sediment movement into restored tidal areas significantly reduce habitat area and/or ecological functioning (such as plankton, benthic, fish or bird diversity or abundance in the South Bay? * Development of a 2- and 3-D South Bay tidal habitats evolution model.	* Convene study session to review and interpret findings to assess if observed changes are due to restoration actions or system-wide changes in the sediment budget (e.g., effects of sea level rise). * Study biological effects of loss of mudflat, subtidal shallows, and/or subtidal channel habitat. * Adjust restoration phasing and design to reduce net loss of tidal mudflats. Potential actions include remove bayfront levees to increase wind fetch and sustain tidal mudflat, phase breaching to match demand and supply, and/or breach only high-elevation ponds to limit sediment demand * Reconsider movement up staircase
Sediment Dynamics Project Objective 1 (Rate of accretion indicates trajectory toward vegetated marsh)	Accretion rate of the restored ponds is sufficient to reach vegetation colonization elevations.	* Areas of inboard mudflat and pioneer marsh inside ponds * Sedimentation rate inside breached ponds. Methods: Transects or SET, annually at first and then less frequently as rates of accretion slow. LiDAR surveys (see above).	* Pond scale	* 2-10 years depending on initial pond elevation	* Projections based on the rate of inboard mudflat accretion suggest vegetation colonization elevations are not likely to be achieved within the planning time frame.	* Will sediment accretion in restored tidal areas be adequate to create and to support emergent tidal marsh ecosystems within the 50-yr projected time frame?	* Convene study session to review findings to assess if observed changes are due to restoration actions and whether colonization is compromised. * Study biological effects of slower tidal flat evolution. * Adjust phasing and design to increase inboard mudflat accretion. Potential management actions include adding wave breaks or adding fill. * Reconsider movement up staircase

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Sediment Dynamics Project Objective 1 (Maintenance or increase of current vegetated marsh is essential to key species)	No long-term net loss of vegetated tidal marsh throughout the South Bay.	Total area of tidal salt marsh Methods: Bathymetry and LiDAR surveys and/or Iconos satellite data and/or aerial photography and ground truthing	Pond Complex and South Bay	10 to 20 years	* Observed net loss of tidal salt marsh (area of outboard fringe marsh losses > greater area of tidal marsh in restored ponds) than the range of natural variability + observational variability/error.	* Will sediment accretion in restored tidal areas be adequate to create and to support net increase in emergent tidal marsh habitat within the 50-yr projected time frame? * Development of a 2- and 3-D South Bay tidal habitats evolution model	* Convene study session to review findings to assess if observed changes are due to restoration actions. * If tidal marsh area is not meeting projections, assess biological significance of long-term loss of tidal marsh. * Adjust phasing and design to accelerate marsh development. Potential management actions include filling to colonization elevations, adding wave breaks and/or preserving bayfront levees * Adjust phasing and design to reduce erosion of existing marsh. For example, phase tidal restoration to match sediment demand and supply.
Tidal Marsh Habitat Establishment Project Objective 1A	Tidal marsh vegetation/habitat mosaic (including vegetation acreage and density, species composition, acreage of mudflat, channels, marsh ponds and transition area) is on a trajectory toward a reference marsh and/or other successful marsh restoration sites in south San Francisco Bay.	* Tidal marsh habitat acreage (e.g., vegetation, mudflat, channel, pan, transition zones, etc.; collected via remote imagery with limited ground-truthing) as a percent of the total restoration area; plant species composition, including abundance of non-natives such as non-native *Spartina* (quadrat or transect sampling once marsh has 40% vegetation cover); habitat trajectory toward a reference marsh and other restoration sites * Habitat mapping will take place every 5 years, beginning 5 years after the restored area has reached vegetation colonization elevation. Once	Entire South Bay	Establishment depends on initial pond elevation, vegetation colonization anticipated to be detectable within 5 years reaching appropriate elevations, while habitat development trajectory anticipated to be detectable within 15 years (and possibly less) of the onset of vegetation colonization	* Vegetation deviates significantly (30-50%) from projected trajectory after colonization elevations are achieved. * Channel and marsh pond formation does not occur as predicted. * Cover by non-native invasive species, especially non-native *Spartina*, exceeds 10% cover within a specific habitat zone of a restored area that the particular invasive species would occupy (e.g., *Lepidium* in the transition zone)		* Review sediment dynamics * Study causes of slow vegetation establishment and channel development (ex: gypsum) * Active revegetation * Increased non-native invasive species control * If invasive species cannot be controlled, study biotic response to non-native vegetation * Adjust phasing and design * Reconsider movement up staircase

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		40% native vegetation cover has been achieved, species composition will be collected (in years corresponding to the habitat mapping) in a variety of zones (low marsh, high marsh, upland transition) within each restored marsh. (It would be beneficial to have increased frequency of monitoring in the early project phases.)					