Appendix E

Natural Sedimentation Assumptions

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We used three scenarios to estimate the time necessary to reach tidal marsh plain elevations on two thirds of the entire South Bay salt pond complex (approximately 18,000 acres). The differences between the three scenarios are the rates of projected sea level rise (1.3 and 2.0 millimeters per year) and the areas requiring "maintenance" sediment deposition (mudflat only or marsh plus mudflat). Descriptions of the three scenarios follow.

Scenario 1: Salt Pond Accumulation and Mudflat Maintenance

- Sea level rise projected at 1.3 millimeters per year.
- 72 million cubic yards of sediment needed for 18,000 acres of salt ponds.
- Sediment deposition maintains restored salt pond elevations in light of projected sea level rise.
- Sediment deposition maintains intertidal mudflat elevations in light of projected sea level rise. Total acreage of 15,000 acres (Goals Project 1999).
- Internal organic matter accumulation (i.e., vascular plant production) maintains tidal marsh elevations in light of projected sea level rise. Total acreage of 10,000 acres (Goals Project 1999).

Scenario 2: Salt Pond Accumulation and Tidal Marsh and Mudflat Maintenance

- Sea level rise projected at 1.3 millimeters per year.
- 72 million cubic yards of sediment needed for 18,000 acres of salt ponds.
- Sediment deposition maintains restored salt pond elevations in light of projected sea level rise.
- Sediment deposition maintains intertidal mudflat *and* tidal marsh elevations in light of projected sea level rise. Total acreage of 25,000 acres (Goals Project).

Scenario 3: Salt Pond Accumulation and Tidal Marsh and Mudflat Maintenance

- Sea level rise projected at 2.0 millimeters per year.
- 72 million cubic yards of sediment needed for 18,000 acres of salt ponds.
- Sediment deposition maintains restored salt pond elevations in light of projected sea level rise.
- Sediment deposition maintains intertidal mudflat *and* tidal marsh elevations in light of projected sea level rise. Total acreage of 25,000 acres (Goals Project 1999).

We made six assumptions to assist us with this analysis. These assumptions are described below.

1. **Assumptions Regarding "Maintenance" Deposition.** The existing tidal marshes and mudflats need to maintain their elevations with respect to the tides over the long term under sea level rise in order to continue providing their ecological support functions. For tidal marshes, we consider two variations for maintaining these elevations. In Scenario 1, we assume that vascular plant growth will provide the necessary accumulation to maintain marsh elevations. In Scenarios 2 and 3, we assume that sediment deposition is necessary to maintain elevations. For tidal mudflats, we assume that sediment deposition is needed under all scenarios.
2. **Assumptions Regarding Sea Level Rise.** In Scenarios 1 and 2, we assume a sea level rise of 1.3 millimeters per year (Titus and Narayanan 1995). For Scenario 3, we use a higher rate of sea level rise corresponding with rates of 1.9 to 2.0 millimeters per year measured at San Diego, La Jolla, Newport, and Seattle.

3. **Assumptions Regarding Sediment Supply.** The calculations presented here use a constant rate of 0.89 million cubic yards of net sediment influx into the South Bay (Krone 1996). According to Schoellhamer (personal communication), this value is the best available today, although its accuracy is uncertain. Whether the rate would change over time is difficult to predict because it is influenced strongly by climate and land use practices.
4. **Assumptions Regarding Restoration Implementation.** For the purpose of simple calculations, we assume restoration starts at time zero. The purpose of this assumption is to consider advantages gained by spreading out restoration implementation to reduce the annual sediment demand, thereby, reducing the potential for sediment scouring from intertidal mudflats.
5. **Assumptions Regarding Sediment Accumulation.** Because the South Bay shows relatively high rates of sedimentation in the shallow margins (e.g., rapid sediment accumulation in local marinas and marsh restoration projects), we assume that sedimentation rates in restored salt ponds will be similar to these regional rates. Therefore, sedimentation to marsh plain elevations would occur in a five to ten year timeframe for higher elevation salt ponds. For the more subsided ponds, sedimentation would occur in a ten to twenty year timeframe. These values are approximate. This assumption is not used in the calculations, but rather in the interpretation of the results relative to sediment scouring of the mudflats.
6. **Assumptions Regarding Sediment Source.** The calculations presented here assume that 100 percent of the sediment supplied to the restored salt ponds comes from a net influx of sediments into the South Bay. The purpose of this assumption is to test the demand for sediment from other sources given the anticipated rate of sediment accumulation. In other words, a low net sediment influx into the South Bay equates to a sediment demand from other sources, not a low sedimentation rate in restored salt ponds.

Given the purpose of this analysis and the assumptions stated above, the results are expected to yield one of three outcomes. These outcomes are fundamental to how salt pond restoration is implemented in an environmentally sound manner.

1. **Relatively low likelihood of scouring mudflats.** If the calculations show rapid (e.g., 20 years) return of marsh plain elevations in the restored salt ponds, then one can conclude that the net sediment influx into the South Bay would provide a sufficient sediment source. The mudflats would probably not be scoured to any significant degree.

2. **Intermediate likelihood of scouring mudflats.** If the calculations show moderate (e.g., 50 years) return of marsh plain elevations in restored salt ponds, then one can conclude that, under a natural sedimentation design approach, the mudflats will experience some degree of scour unless restoration implementation is spread out over a longer timeframe.

3. **Relatively high likelihood of scouring mudflats.** If the calculations show slow (e.g., 100 years) return of marsh plain elevations in the restored salt ponds, then one can conclude that, under a natural sedimentation design approach, sediment is likely to be drawn from mudflats to make up the sediment deficit and maintain sedimentation rates. Therefore, restoration implementation must spread out over many decades or utilize dredged material to avoid mudflat scour.