San Francisco Bay Sand Budget

Lester McKee, SFEI Presentation for the Sand Budget Discussion meeting 10am-12pm, August 21, 2024

What is a Sediment Budget

- "A statement of the net quantity of sediment deposited or eroded balanced against the sum of sources and external sinks" (Hobbs et al., 1992)
- Mass (or volume) must be conserved "inflow minus outflow must equal the change in storage" (Schoellhamer et al., 2005)
- For a given control volume and period of time:
 - Change in Bed Storage (functionally elevation) = Inflow Outflow
 - If inflows are smaller than outflows, bed erosion must occur









Control Volume: Boundary Conditions and Assumptions

Space - San Francisco Bay

- Mallard Island → Golden Gate Bridge
- Bay is everything below head of tide
- Wetland deposition is assumed to be permanently stored

Accounting period

• 2001-2020

"Active" bed sediment

 Any sediment that is exposed to estuarine currents at any time during the accounting period



Sand Sediment Budget - Whole Bay



Sand Sediment Budget – Suisun Bay



Sand Sediment Budget – Central Bay



How Much Sand is there in the Bay?

- During the 2001-2020 budget period:
- 0.45 million metric t/y of sediment came into the Bay from tributaries and littoral sand transport, and
- 1.33 million metric t/y of sand was sourced from the bed of the Bay
- The sum is the amount of sand that was "in the system" (0.45 + 1.33 = 1.78 million metric t/y)

- We did not report legacy sediment that is outside the "control volume"; Sediment
 - below the active bed,
 - stored in the wetlands,
 - in beach or dune deposits.
- These are in "permanent storage" and not actively contributing to sand transport (the budget)
- Sand volumes in these pools are MASSAVE compared to the budget

How Does Mining Affect the Budget?

- Sand mining is the largest term in the <u>meta-scale whole Bay</u> sand budget and in the macro-scale Suisun and Central Bay budgets. Mining undoubtedly has an influence on the Bay morphodynamics at these scales.
- If the sand mining were to be "turned off", since <u>sand mining is a large term</u>, there would be <u>large changes to other elements</u> in the budget.
- BUT, the meta- and macro-scale budgets are not suitable for predicting the actual changes that would occur (specific impacts) if the location or amount sand mining had been different during the 2001-2020 budget period.