Appendix 2: Preliminary Costs Estimates

Costs of labor and materials change over time; the information presented below represent preliminary estimates for 2023.

Regional

For the regional habitat map, the mapping and interpretation relies on several component parts: 1) obtaining appropriate imagery, 2) obtaining LiDAR (see estimates on regional elevation map below), 3) staff time for data management and processing (training and validating e-Cognition software), and 4) conducting relevant analyses using mapping results.

- The cost estimate for obtaining imagery for 4 band 60 cm spatial resolution (~ $175/sq mile) tide controlled and collected in the summer is $120,000. Alternatively the frequency of remapping could be shifted to an even number of years (e.g. 4 or 6 years vs 5 years) in order to use free NAIP imagery collections (4 spectral bands and 60 cm spatial resolution, but likely without tide controlled collection). Opportunities to coordinate aerial imagery collection with partners (e.g. Bay-area Counties, NASA, others) for cost-sharing benefits can be explored.
- Cost estimates for staff time to manage habitat map: (e.g. number of hours x average rate)
- The regional elevation map cost estimate is based on past NOAA Coastal Geospatial Services Contracts. It is estimated that a tide-controlled LiDAR collection and delivery of QL1 LiDAR products would cost roughly $280/square mile. Assuming a study area of 678.6 square miles that is approximately $190,000. Ideally LiDAR data will be collected as close in time to imagery collected for the bayland habitat mapping effort.
- Additional costs (staff time for processing, other?) associated with creating updated DEM using LiDAR and best available tidal datums (see section below):
- Cost estimates for staff time to analyze maps for change detection and analysis of interest: particularly Shoreline Change Detection and other early analyses such as UVVR.
- Cost estimates for vegetation mapping is based on both Pacific VegMap and HEMP-type vegetation mapping. Upper cost estimate is $2M, with an estimated cost of $3-$5 per acre for detailed classification. These cost estimates include field work, software and staff time, while leveraging free multispectral imagery and LiDAR. Between 1⁄3 and ½ of the budget could be spent on a field campaign for calibration/validation, which potentially could be reduced if paired with other field campaigns.

Subregional

Many sensors collecting subregional data are hosted by larger organizations such as USGS, NOAA or a county's Flood Control and Water Conservation District. Costs can include the equipment, installation, maintenance and if applicable costs to read the instrumentation (such as with SET-MHs).

- For tide gauges, installation costs for each new WRMP tide gauge are estimated at roughly $11,000 per site. Long-term installations will have estimated annual costs for maintenance/calibration at roughly $600 per site. Installation costs include field time for staff that can simultaneously be used to support installation of other field sampling equipment to

measure salinity (see Section 4.3 above), suspended sediment (see Section 4.4 above), and other WRMP indicators. See the HGM SOP for additional details.

- Costs for water quality sensors such as DO, SSC, and surface water salinity can be bundled together within a sensor. Multiparameter sondes such as a YSI EXO2 Multi-parameter water quality sonde costs roughly $20,000 with 6 sensors and a wiper port. Costs for a multi-parameter sonde depends on the number of sensors included. Costs estimates for instrumentation maintenance, sample collection and analysis is $9,400.
- For porewater salinity or groundwater salinity, either a shallow well with an electrical conductivity sensor or a porewater sampling device (eg., sipper or a Rhizon sampler) needs to be used. The cost for Rhizon samplers is about $200 for a pack of 10 with an accompanying syringe. A conductivity, temperature and depth sensor, which can be used for groundwater monitoring, cost in the range of $500 - $1000. Costs for processing pore water salinity is estimated at $100.

Site-scale

Site-scale cost estimates involve considering factors such as equipment procurement, personnel training and field time, data collection frequency, and laboratory analysis, with a focus on ensuring comprehensive coverage and accurate representation of ecological dynamics. Cost estimates are originally taken from (WRMP 2020b) and have subsequently been updated where possible/necessary.

- CRAM practitioners have proposed an initial cost estimate of $90,000 to implement CRAM at roughly 30 AAs at WRMP sites during the first year of monitoring. This estimate includes startup time for experts to coordinate with the TAC to outline the initial goals of the Level-2 monitoring for the WRMP. Other costs include: (1) developing a detailed near-term sampling and analysis plan, (2) executing the CRAM assessments in the field, (3) conducting data entry, QA/QC and data analysis, and (4) reporting back to the TAC with a brief summary memorandum of the WRMP's CRAM monitoring effort. It is expected that future annual monitoring costs may be reduced once the WRMP establishes a long-term plan for Level-2 assessments within the program. For now, however, startup and science advisory planning costs are included in this initial annual cost estimate.
- Estimated costs for new SET-MH installation are approximately $13,000 per site. Estimated costs for annual reading of the regional SET-MH network and associated data analysis/reporting with the current number of network sites are roughly $20,000 per year with those costs increasing as sites are added.
- Costs for vegetation transects include purchasing and pre-programming tablets for data collection, which can cost $1,000. If vegetation transects are done concurrently with elevation transects, a high-precision GPS unit is not required since latitude and longitude can be recorded with an RTK-GNSS. However, if a high-precision GPS unit (centimeter accuracy) is required they range from $6,000 - $15,000. Ongoing fieldwork costs for gradsects or standard vegetation surveys can range from $1,500 to $3,500 per site. Elevation transects Costs of a new RTK-GNSS system can cost upwards of $15,000 however these systems can be rented or bought used. Costs to do field transects alone for elevation cost roughly $1,900 - 2,300 per

site. If concurrently conducting vegetation surveys with elevation transects, the cost per site is reduced.

- Fish survey costs depend significantly on the sampling methods and frequency; therefore, the cost estimate is a wide range. Costs for monthly fish sampling for abundance, community composition, and distribution is between $50,000 - 200,000.
- Cost for a site-visit is estimated at $2,000 and ongoing surveys between $2,500 and $9,500 for two tidal marsh bird surveys or for a secretive marsh bird survey (mainly focused on the endangered California Ridgway's rail) that require boat access. TBD (separate estimates for tidal marsh birds at regional, sub-regional, and project levels).
- For mammal surveys such as the salt marsh harvest mouse, costs include initial start-up time. This includes about 8 hours of setting up a survey grid (2 people/4 hours), and an ongoing cost of $5,000 for one survey by a consulting firm. However, some marsh mammal monitoring, mainly focused on the endangered salt marsh harvest mouse, currently occurs throughout the Estuary
- Carbon sequestration - costs estimates for carbon sequestration are not yet available, however in the future if there is more interest and funding available this section can be expanded and a cost estimate developed.