Guadalupe River Hg – Options for Continuation
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Background

Objective: Characterize concentrations and loads during high flow periods to gain an accurate understanding of contaminant inputs from the Guadalupe River watershed to the Bay under all annual flow conditions and on average.

Work to-date: SFEI, MLML, RSL, and USGS have been working together with funding from CEP, RMP, SCVWD, USACE, and SCVURPPP to characterize the concentrations and loads of suspended sediments and total Hg (WY 2003, 2004, 2005, 2006), and bed loads, bed sediment Hg loads, methyl Hg (WY 2005). The CEP and RMP also funded the collection of PCBs (WY 2003, 2004, 2005, 2006), OC pesticides (WY 2003, 2004), and PBDEs (WY 2005, 2006). The following observations and hypotheses have been generated with respect to water, sediment and mercury:

- Data collected at Hwy 101 indicate the watershed efficiently transports water and sediment downstream in response to rainfall and reservoir releases. Discharge and SSC respond to rainfall in the urbanized lower watershed within 30 minutes. Discharge and SSC respond to rainfall on the mountain peaks within 6 hours.
- When either the Guadalupe Reservoir or Almaden Reservoir is released, a discharge and SSC response occurs at Hwy 101 approximately 5 hours later. Data indicates that Lake Almaden (next to the District Headquarters) has little attenuating influence on the discharge or SSC signal.
- During WY 2003 - 2005, suspended sediment concentrations have varied from 5 – 1,180 mg/l and loads have varied from 4,600 – 10,800 t. WY 2006 will likely fall on the upper end of this range ~11,000-12,000 t).
- During WY 2003 - 2006, total Hg concentrations varied from DL - 18,673 ng/L (some of the highest concentrations measured in the world and indicative of mining contamination).
- Concentrations of other trace metals (e.g. Cu and Pb) and PCBs are greater when discharge is derived from urban areas whereas concentrations of Hg, Ni and Cr are greater when discharge is derived from the upper non-urban portions of the watershed.
- Highest total Hg concentrations occur when rainfall in the Historic Mining District is more intense (approaching or >2 in / 6 hours measured at Almaden).
- All observations support the hypothesis that the majority of total Hg transported in the system is derived from out of channel sources in the Historic New Almaden Mining District (could include floodplain and terrace deposits in first and second order tributaries). We do not see elevated Hg concentrations in response to high tributary flows under lower rainfall intensity conditions, or in response to reservoir releases. Other mercury sources such as runoff and channel erosion in the urban areas, erosion from Lake Almaden, atmospheric deposition, and channel erosion in Alamitos Creek and Guadalupe Creek mainstems appear to be subordinate.
- During WY 2005 and 2006 (preliminary data), concentrations of methylmercury ranged from 0.06 – 2.22 ng/L.
- Mercury concentrations in the bed load sediments of Guadalupe River ranged between 0.03 and 1.8 mg/kg (median of eight samples) and increased with decreasing grainsize. Large variation between samples indicated slugs of contaminated sediment (perhaps even chunks of cinnabar probably associated with any particle size). Maximum concentrations in the bed on the fine sediment (<0.0625 mm) approach the particulate concentrations found in the water column during smaller most common floods (e.g. WY 2004, 2005). However, under high Hg transport conditions (e.g. WY 2003), Hg in the water column well exceeds bed concentrations indicating loads, if calculated from bed sediment data, would be bias low by an unknown amount. This observation also adds further support that most Hg load in not sourced from in-channel deposits.
- During WY 2003 - 2005, total Hg loads have varied from 8 - 116 kg. WY 2006 will likely fall in the middle of this range ~ 20 - 40 kg).
- Bed sediment load was 1% and methyl Hg load was 0.5% of total Hg load during WY 2005.

Options for Continuation

Option A: Discontinue study

Advantages: RMP money can be put into studying another small tributary.
SCVWD/USACE money can be put into implementation projects to reduce Hg load.

Disadvantage: - The source analysis in the Guadalupe TMDL is based upon very little high flow data. Loads from areas within and adjacent to the Historic Mining District are presently bias low by an unknown amount.
- There remains scientific dispute on the relative importance of each Hg source.
- Concentrations in the water column during small floods or in the bed at any time are NOT representative of high Hg load periods.
- We have just 1 year of data (26 samples) during high Hg release conditions collected during the first year of study when the study team was ignorant of source-release-transport processes. This will NOT be sufficient to use as a baseline to compare to future conditions.
- Data suggest that Hg transport in the Guadalupe River system is associated with catastrophic release. If that is true, the average load estimate to the Bay is severely bias low.

Cost: $0k/y

Option B: Continuation (status quo).

Continue study during the wet season focusing on floods when the majority of sediment and Hg transport occurs. This would include: 15 minute turbidity, USGS sediment daily loads program, water sampling (50 samples for Hg, 15 samples for trace organics), lab analysis by MLML and AXYS.

Advantages: - Collection of data under the full variation in rainfall distribution and intensity and runoff from reservoir release and all sources areas in the watershed.
- Very accurate estimate of loads.
- Data also most useful for any future development of model to test BMP scenarios.

Disadvantages: - Cost
- Might take many more years to sample large storms.

Cost: $80k per year (local sponsor) + $50k per year (RMP) = $130k/y.

Option C: Large floods only (falling stage)

The objective is to determine particle concentrations during large floods and provide baseline data for future comparisons. We propose to continue to operate the turbidity probe and USGS daily loads program at Hwy 101. We propose to take water samples for Hg analysis during floods of increasingly larger magnitudes. Initially we would sample rainfall intensity >2 in/ 6 hours (Almaden gage) or a flood >12 ft (USGS Hwy 101 gage). As data were gathered annually we would only sample larger and larger floods. Each time a larger flood occurs, a new threshold trigger discharge would be emplaced for further sampling. In this way, over the next decade we would gradually gather information on larger and larger floods. Under this option, we would only sample falling stages of floods when Hg is transported from the non-urban upper watershed areas and Historic Mining District.

Advantages: - Cheaper than sampling all floods every year.
- Will provide baseline data for future comparisons.
- Will allow annual estimate of suspended sediment load useful for other District projects

Disadvantages: - Will be less informed about Hg and trace organic transport associated with urban areas.
- Confidence of annual loads will be lower.

Cost: $35k per year (USGS) (every year ongoing)
$15k (SFEI labor) + $10k (Hg lab analysis) only when a large flood occurs = $25k
$140k full study every 5 years (next time would be in water year 2011)