Requested Revisions to Technical Memorandum #2: WLAM Update and Recalibration

1) Please describe how dam operations (7 Oaks & Prado) are handled when calibrating the flow model. Need to note that ACOE does not always follow their own formal operating rules for the dams and that there is no way to predict these deviations in the WLAM. This is especially important for the 2010-11 wet season.

2) Please describe in greater detail the flow and water quality data provided by the POTWs. Was this data assumed to be QA/QC'd by the provider or did Geosciences do additional QA/QC on the data? Did POTWs provide daily data for TIN & TDS or were the monthly averages assigned to all days in each month?

3) There are significant discharges from the San Bernadino's geothermal plant to Warm Creek. These do not appear to be accounted for in the model calibration and may explain some of the discrepancy at this station.

4) Discharges from Eastern Municipal Water District are not depicted on several figures including: Fig. 12, Fig. 35 & Fig. 43 (and there may be others). EMWD is also not listed among the POTW discharges described in Section 2.3.8 on pg. 9 of the report.

5) On occasion, under certain extreme wet weather conditions, the Cities of San Bernardino and Colton may discharge directly to the river rather than sending secondary effluent to RIX for filtration. Although rare, these discharges may be confounding the calibration. Please check with POTWs for more details regarding these events.

6) Historically, SBVMWD has operated a dewatering discharge of approximately 6.3 cfs. This does not appear to be accounted for in the calibration. Please check with Valley District to determine if the discharge is still occurring.

7) Historically, there was up to 7.9 cfs of discharge from the Arlington Desalter. This does not appear to be accounted for in the calibration and may explain some of the discrepancy at Temescal Creek. Please check with SAWPA to better characterize these flows.

8) Please indicate whether salinity data was originally provided as TDS (mg/L) or Electrical Conductivity (uS/cm) and what conversion factor was used to translate between these different measurement units.
9) Please prepare a table summarizing key similarities and differences between the 2002 WLAM, the 2015 WLAM (Scenario 8) and the 2017 WLAM including, but not limited to, the following categories: land use data, precipitation data, gauge data, number of sub-areas, POTW data, soil data, evaporation stations, nitrogen reaction coefficients, calibration period, calibration endpoints (R2, RMSE, other), etc.

10) Please describe why Geosciences elected to estimate local rainfall using the Prism contours rather than the Thiessen Polygon approach used in the previous WLAM.

11) The new and prior WLAM presume that TIN concentration in water leaving the Prado Wetlands (operated by OCWD) is 1 mg/L (see pg. 13). Do we have data to defend that conclusion? If so, it should be cited in a reference. Perhaps OCWD has better data with higher resolution under a wider variety of input conditions. This may improve the TIN calibration at Prado Dam.

12) The WLAM should probably be revised to treat the Prado Wetlands as a discrete impoundment so that the model can better account for the minor evapotranspiration losses that occur for river flows diverted through those ponds. This will probably improve the TDS and flow calibration at Prado Dam.

13) Please provide a new subsection describing the side-by-side analyses of the 2015 (Scenario 8) WLAM vs. the HSPF model for the upper Santa Ana Watershed that Geosciences performed at the outset of this effort.

14) For all tables showing the relative percent error between modeled and observed scores, please add a footnote indicating how the percent error was calculated and whether a negative valence indicates that the model is over- or under-estimating in relation to the measured value.

15) Please add text explaining that the HSPF model is used to calculate precipitation runoff in Reach 2 of the Santa Ana River (see green area in Fig. 5). OCWD's RFM model is only used as an accounting tool to track diversions and recharges not to estimate runoff from adjacent land areas.

16) Please add text explaining that variance at very low flows may be partially explained by sensitivity and precision of the gages at their detection limits (e.g. 0.1 cfs - 1.0 cfs). See Fig. 26 for example.

17) IUEA's RP-2 treatment plant was decommissioned in about 2002. The loss of perennial flows probably altered the subsequent streambed percolation rates in Chino Creek. This may explain some of the calibration problems at this station.
18) Figure 22 and Figure 33 are entitled: "Inflow to Prado." This is somewhat confusing. Since the USGS gage is located below Prado Dam (in Reach 2 of the SAR), is this really referring to "Outflow from Prado?"

19) Neither the old nor the new WLAM explicitly account for dry weather urban runoff caused by return flows from landscape or crop irrigation. At some times and places such flows can be quite large. In addition, there is a long-term declining trend in such flows in response to conservation efforts. If there is no way to account for these flows, then the text should acknowledge their existence and indicate that this may explain some of the discrepancy between measured and observed values particularly in dry weather, low flow conditions.

20) Figures 51 thru 56 present daily water quality data. Similar graphs should be prepared showing the relationships based on monthly averages.

21) Please describe how the new WLAM accounts for diversion of dry weather flows and stormwater flows to off-channel recharge basins (esp. in San Bernardino County).

22) Please provide a more detailed explanation of the decision criteria used to include or exclude data from rainfall gaging stations. Why did Geosciences use far fewer precipitation stations than were used in the previous WLAM (see Section 2.3.4 on pg. 7 of the report)?

23) It appears that there are very little TIN data available at most gaging stations. It may be possible to augment this dataset by computing a synthetic TIN value by summing the value of Ammonia + Nitrate + Nitrite. Nitrite is not critical to this computation as the concentration is usually very small.

24) Please describe what TIN and TDS concentrations were assumed for mountain runoff and wet weather urban runoff and dry weather urban runoff? What was the scientific basis for these assumed values? Please provide relevant reference citations.

25) Please add text explaining the unavoidable discrepancies associated with delays between the rainfall event and when the runoff reaches a gage. For example, rainfall that begins late at night one day and flow gage data that spikes the following day. This is why the monthly data generally calibrates better than the daily data. Add text noting that, given the primary use of the WLAM (e.g. to protect groundwater quality), calibration to a monthly time step is more than adequate to implement Basin Plan objectives (note: groundwater objectives are calculated as a 20-year average and recharge compliance is computed using a 10-year average). It should also be noted that we rarely have accurate daily data for some non-tributary discharges (e.g. OC-59 deliveries of SPW)
26) Please add text describing the significant channel improvements that have been made to San Timoteo Creek over the last 10 years and note the impact this has on the model calibration. See Fig. 33. Note: San Timoteo is misspelled as "San Temoteo" in numerous places throughout the document.

27) Please provide a more detailed description of the precise methods used to account for the amount of flow, and related water quality of those flows, for rising groundwater at the Riverside Narrows and at Prado Dam. Compare and contrast the method(s) used by Geosciences to that used in the previous WLAM. Discuss Pros and Cons of both methods and, in particular, how the different methods may affect subsequent calculations required by the RFP-SOW for this project (e.g. Task 3b: volume and quality of water recharging to each individual aquifer through streambed percolation from each surface segment of the river).

28) It may be appropriate to do some formal outlier analysis for those data points where the model estimates and the observed values differ by more than two orders of magnitude (see, for example, Figures 32, 35, 36 & 41). Such discrepancies seem quite large even if the overall average relative percent difference is small. Large differences in both directions tend to cancel each other out and give the illusion that the overall error is small when it is not. This analysis should focus on only the most extreme deviations which would have the greatest adverse effect on R2 values. For example, in Figure 37, there seem to be several instances where the model predicts flows in the 0.1 to 1.0 cfs range but the measured flows range from 10 to 100 cfs. This may be an example of where the model cannot account for excess irrigation runoff in the Arlington orchard area that ultimately drains to Temescal Creek.

29) Please provide a detailed forensic analysis of how the prior WLAM was able to achieve an acceptable R2 value at San Timoteo when the new WLAM did not.

30) Please provide a detailed forensic analysis of how the prior WLAM was able to achieve an acceptable R2 value at Chino Creek (Schaefer Ave.) when the new WLAM did not. Figure 20 appears to indicate that the old WLAM established a minimum flow and truncated all model estimates below that threshold.

31) Please provide a detailed forensic analysis of how the prior WLAM was able to achieve an acceptable R2 value at Temescal Creek when the new WLAM did not. Figure 15 appears to indicate that the old WLAM established a minimum flow value and truncated all model estimates below that threshold.

32) Please provide a reference citation for the "Standards and Guidelines" for calibrating HSPF models that is described on page 3 of the report.
33) Please provide a more detailed explanation of the steps used to perform a QA/QC review of the flow data, TIN data and TDS data used to populate the new WLAM. Please add text indicating that Geosciences did not re-evaluate prior data that had already been QA/QC’d as part of the 2015-Scenario #8 WLAM prepared by WEI. Only new data collected after 2012 was QA/QC’d by Geosciences.

34) Please provide a reference citation for the source of data used to describe characteristics of the storm channels in Figure 11. All three counties were required to submit GIS layers and an Access Database describing the flood control channels to the Regional Board as part of the 2012 Basin Plan amendment for bacteria standards.

35) Please add USGS Gage number, Lat/Long coordinates, and period of record to the list of stations shown on page 12 of the report.

36) Please add actual R2 values to each cell in the table shown on page 15 of the report.

37) Please add text emphasizing the new WLAM used a different calibration period (WY2006-2016) then the 2002 WLAM (WY1999-2006) or the 2015-Scenario #8 WLAM (WY1995-2006). The computed R2 values for the two older WLAM should not be compared directly to the R2 values for the new WLAM. Rather, the older R2 values were computed solely to determine what has been previously considered acceptable level of model performance.

38) Please provide a footnote to the last sentence on page 3 of the report describing the website address where the HSPF software and user manual can be downloaded.

39) Please provide additional description and explanation of "GoldSim" where that model is first discussed on page 4 of the report.

40) The report should add text explaining that the prior WLAM also did not attempt to optimize the water quality predictions by maximizing R2 or minimizing RMSE because there wasn’t enough data to do so.

41) Please add a section at the beginning of the report describing the chronology of WLAM development. It is important to distinguish the WLAM that was developed in 2002 (approved by the Regional Board in 2004) from the updates that were developed in 2008-9 and finalized (as Scenario #8) in 2015. Only the 2002 version was actually approved by the Regional Board. While the 2008-2015 versions were submitted to Regional Board staff for review, they were never agendized for formal Regional Board approval. In addition, the nomenclature for referring to all of the various WLAM versions needs to be standardized throughout the report.