Coachella Valley SNMP - TM-2, Response to Comments

General Notes:	**Based on comments from stakeholders, revisions were made to Technical Memorandum No.2 (TM-2). Two key comments were fundamental to process, these include the use of a 20-year baseline period and the adequacy of data for contouring water quality. As such, general comments are provided herein to address these key issues independent of specific stakeholder comments.**
Adequacy of Data	An attachment to TM-2 was prepare that describes the methods applied and results obtained to evaluate the data adequacy of contouring water quality constituents for management zones and aquifer layers. The volume-weighted method for determination of ambient water quality (AWQ) is used when an adequate amount of data exist for a particular management zone or aquifer layer. This method computes the average water quality based on the amount of mass of a particular constituent in storage. The mass of the constituent is determined by multiplying the water quality concentration by the amount of water in storage at a point of discrete "cell". The concentration of a discrete cell is based on either the actual data or an interpolation based on surrounding data using a water quality contour map. The contour maps are typically prepared with oversight from a professional geologist or engineer and completed in an iterative fashion using numerical and hand contouring methods. Determination of data adequacy for contouring the water quality of an aquifer layer within a particular management zone is not a well-defined undertaking, but it is important for applying the volume-weighted method. The determination of adequacy is based on the following key factors, spatial distribution of data points – the physical location of data points within a management zone or aquifer layer has a marked effect on the ability to approximate values with certainty; spatial autocorrelation – the assumption that one value is more related to nearby points and less related to distant points; and supporting statistics. The attachment provides an evaluation of these factors for management zones and aquifer layers over different periods of time. At the conclusion of the attachment are recommendations for the most appropriate method of AWQ calculation—volume-weighted method or statistical summary—based on the available data.
Baseline Period	When considering the time period for the AWQ calculation, the quantity of data points gained from using older records must be balanced with the desire characterize current water quality (less data). To evaluate the potential impact of older data a trend analysis was completed. Water quality trends were reviewed in TM-1 that considered historical and vertical records throughout the Valley. In addition, a Mann-Kendall analysis was completed within TM-2. A Mann-Kendall trend analysis tests for statistically significant trending in water quality records. A Mann-Kendall test is a widely used method for evaluating trends that compares samples for a particular well and tests for a positive (increasing) or negative (decreasing) trend result for a particular level of statistical significance; see Data Quality Assessment: Statistical Methods for Practitioner (EPA, 2006). Only records with a prescribed number of well records could be considered - not all wells could be evaluated. The results of the Mann-Kendall trend analyses for TDS and nitrate indicate an increasing trend in concentration with time. Based on this consistent result, using older records, generally speaking, decreasing the accuracy of an AWQ calculation or statistical summary if the objective is to represent current water quality. Although due to the size of the Valley, using "current" or even records for all wells within the last 5 years in not feasible due the effort and cost associated with sampling. Based on this consistent result, using older records may underestimate the AWQ if the objective is to represent current water quality. To obtain the most representative AWQ, the most recent measurements are used for each well. The use of the most recent measurements is a change in approach from the first draft of TM-2. . The most recent data point is considered the yearly median if there are multiple data points for a well in a single year. Based on the results of data adequacy (Attachment A), no records will be used that are older than 15 years.

Stakeholder	No.	Comment	General Topic	Response
BIA	1	The baseline TDS and Nitrate concentrations used for establishing the Assimilative Water Quality numbers should be included as well as a citation from the document from which they were sourced.	General	The data, and their sources, are being provided on the SNMP website.
BIA	2	The basins are being described by the data blocks of one thousand square feet. The total numbe of blocks as well as a conversion to square miles (or kilometers) within each basin description would be informative information.	Filtering	Commented noted. Text was modified to reflect the comment by adding spatial statistics for each management zone.
VSD	3	The TM is thorough and well prepared.	General	Comment noted.
VSD	4	The non-detect sample results explanation on page 6 is thorough and acceptable. As stated, this treatment will cause a computed "average" value of the data set to be less than or equal to the actual average value. In actuality, it will always be less than the actual value. The only concern that remains is what impact this will have on assimilative capacity and permit levels.	Data	For datasets with significantly more non-detect results, the skewing effect of this substitution is magnified. However, substitution with zero is consistent with recommended standard practices found in EPA's Data Quality Assessment based on the number of non-detects in the SNMP dataset; this suggests that the effects of this substitution for the determination of AWQ is minimal. To minimize this risk, substitution with half of the most common (mode) nitrate detection limit is used. Because a majority of the records are not accompanied with a method detection limit, using half the detection limit (the other recommended method by EPA) is not possible for all records. Instead, half of the mode of the listed detection limits for all records was used. One half of the mode detection limit (0.02 mg/L) is 0.01 mg/L.
VSD	5	What is considered "sufficient" data for the volume weighted method of Ambient Water Quality determination? (Pages 9, 34, 39).	Data	An attachment has been included that provides an evaluation of data adequacy or data "sufficiency" within the study area for use in the ambient water quality calculation.
VSD	6	All of the information regarding unfiltered data sets, filtered data sets, and volume weighted calculations (where available) are presented in a thorough and deliberate way to present the process of filtering the data and illustrate how the filtering affects the AWQ result. However, a summary table at the end of each section that compares the mean or median and range for each of the data review methods would be beneficial.	General	A summary table was prepared for the volume weighted method (when applicable) and the filtered data within the TM (including mean, median, range, count, mode, standard deviation, and 95 percer confidence interval). The unfiltered data is presented within the text for the purpose of transparency. These data should not be used for conclusion purposes as the results can be misleading (skewed by location, skewed by data frequency etc.) as described in section 2 of the TM.

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VSD	7	On page 15, Section 3.1 , last sentence: the word "Recent" should not be capitalized.	Editorial	In this context, "Recent" is used as a proper noun describing the current geologic time period, the last 11,700 years of the Earth's history — the time since the end of the last major glacial epoch, or "ice age." The term is modified to "Holocene (Recent)" to avoid confusion with the adjective use of the word.
VSD	8	On page 23, Section 3.2.2, second paragraph, last sentence should read: "Higher TDS readings ..... "	Editorial	Commented noted. Text is modified to reflect the comment.
VSD	9	On page 25, Section 3.2.3, first full paragraph, third sentence: replace "further" with "farther."	Editorial	Commented noted. Text is modified to reflect the comment.
VSD	10	On page 28, Section 3.3, last sentence: the third word "is" should be replaced with "was".	Editorial	Commented noted. Text is modified to reflect the comment.
VSD	11	On page 28, Section 3.3.1, fourth sentence: the phrase "data gap" is repeated.	Editorial	Commented noted. Text is modified to reflect the comment.
VSD	12	On page 39, Section 3.5.2, the word "values" should be added between "TDS" and "and".	Editorial	Commented noted. Text is modified to reflect the comment.
VSD	13	Attachment A, Section 3, second paragraph, last sentence: the word "are" should be added between "used" and "presented".	Editorial	Commented noted. Text is modified to reflect the comment.
VSD	14	Attachment A, Section 4, first paragraph, fourth sentence: the word "of" should be added between "part" and "the".	Editorial	Commented noted. Text is modified to reflect the comment.
ACBCI	15	S 2. 1; P 6: The referenced USEPA guidelines for addressing ND in analysis of water quality data provides a more conservative method using half of the detection limit. What effect would this have on the resulting AWQ calculation? Would this be more appropriate method to safeguard the aquifer? The EPA document entitled: Data Quality Assessment: Statistical Methods for Practitioners EPA QA/G-9S, EPA/240/8-06/003 notes on page 131: "If a small proportion of the observations are non-detects, then these may be replaced with a small number, usually DU/2, and the usual analysis performed. Alternative substitution values are 0 (see Aitchison's Method below) or the detection limit"	Data	See response to VSD's comment (No. 4). Based on comments, the half of the mode of the listed detection limits was applied for all non-detects to be conservative. This is consistent with your proposed conservative approach.
ACBCI	16	S 2.2.2: Temporal filter 2 calculates a baseline well concentration using a median (frequency statistic) versus an average (volume statistic). Does this method provide a less conservative value for the AWQ? The temporal filters do not account for wells with clear trends in water quality such as the Palm Springs area wells (04S05E04N01 S and 04S05E09N03S) with TDS, or the Palm Desert wells with nitrate. Should the AWQ at these wells be the most recent data for a baseline determination of ambient water quality?	Filtering	The median does not necessarily favor lower values for AWQ. The reason this statistic is chosen for the filter is that it arguably provides some protection against outliers for a particular dataset.
ACBCI	17	S 2.2.3: The spatial filter is described as calculating a cell-layer average based upon the baseline well concentrations. This method does not account for water quality data that shows a trend in concentration.	Filtering	Commented noted. AWQ is intended to quantify ambient conditions. Water quality trends were evaluated using a Mann-Kendall trend analysis which indicates which wells have increasing, decreasing or no statistical trends. Several increasing trends were observed. As such, the AWQ calculation method was revised to take the most recent yearly median for each well. Using the most recent data should improve the representation of current water quality.
ACBCI	18	Figure 3-1: This figure shows the 20-year unfiltered data statistics for each Management Zone. Please add the average statistics to these graphs. The median value plots closer to the 25-percentile than the mid-point between the 25- and 75-percentiles. Does the median statistic introduce a bias towards a lower AWQ?	Editorial	By definition, the upper and lower limits of the central box are defined using quartiles. Quartiles are the 25th, 50th and 75th percentiles of a data set. The observation that the median plots closer to the 25th percentile indicates that the dataset is not normally distributed; instead it is skewed toward the lower end of the range. The box plot is simply a way to summarize the data. The mean is added to the figure for convenience.
ACBCI	19	Table 3-3: Please provide the volume-weighted AWQ by layer.	AWQ	Comment noted. Managing or regulating at the aquifer level is not consistent with the Recycled Water Policy. The mass of constituents is calculated for separate zones and then aggregated together. This is consistent with the Recycled Water Policy that states salts and nutrients from all sources be managed on a basin-wide or watershed-wide basis. However, it is still useful to understand how water quality varies with depth. Therefore the volume-weighted AWQ by layer has been incorporated into the TM.

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MSWD	20	Section 1, Introduction: The first paragraph indicates "TM-2 summarizes the results…based on the methodology described in TM-1" must also recognize that if MSWD disagrees with the methodology in TM-1 then, of course, MSWD disagrees with the summary of results. In addition, based on paragraph 2, a majority of the SNMP scope of services is still to be completed. Yet, during the October workshop, it was indicated that only one workshop remains. MSWD requests that workshops continue until the plan is complete. Also, the second paragraph refers to tasks to be completed but does not identify needed projects to manage salt and nutrients.	General	A significant portion of the SNMP scope of work is still being completed, this scope of work includes identification of projects and strategies to manage salt and nutrients. This task will be documented in the final SNMP. An Additional workshop has been added to the project schedule to address this. Six stakeholders meetings have been planned for the project, as well as a workshop with the Regional Water Quality Control Board. Stakeholder meetings will continue until the plan is completed.
MSWD	21	Section 1.1, Background: The paragraph states "One objective of the Policy is that salts and nutrients from all sources be managed on a basin-wide or watershed-wide basis that ensures meeting water quality objectives and protection of beneficial uses." First, water quality objectives and beneficial uses are two distinctly different outcomes. Secondly, to date, the neither technical memorandum discusses "all sources". Third, prior to completing the SNMP, RWQCB position on these issues must be incorporated. Is it the intent of MWH to advise the RWQCB what their direction is, instead of asking them what their direction is?	General	Yes, meeting water quality objectives and protecting beneficial uses can be considered different goals. The project technical team continues to work with stakeholders and the RWQCB to get their feedback on this issue. The development of an SNMP is a stakeholder driven process.
MSWD	22	Section 1.2, Salt and Nutrient Management Planning Area: A portion of MSWD's service area overlies SGPWA jurisdictional boundaries.	General	Commented noted.
MSWD	23	Section 1.3, Salt and Nutrient Management Plan Development: The title of this section is misleading. The discussion is describing the contents of TM 2, not the SNMP.	Editorial	Commented noted. Text is modified to reflect the comment.
MSWD	24	Section 2, Ambient Water Quality Methods: In response to "single concentration value that is representative of water quality within a management zone for a particular constituent and time period", MSWD does not agree. The management zones are essentially the sub basins which can have inherently different characteristics within different areas. More refinement is necessary to identify subareas within the management zones. Also more attention should be given to the production areas. The spatial and temporal approach does not accurately reflect actual conditions. It should be focused on pumping areas. In addition, averaging the data set over the past 20 years isn't appropriate. The present ambient levels are more relevant data sets.	AWQ	For each management zone, the AWQ by cell is shown in graphical form, as well as areas above and below the AWQ. The areas where more data is needed will be linked to the Recycled Water Policy-required monitoring plan. Assimilative capacity is a single number per management zone and provides one method of assessing recycled water projects and other discharges at the basin/subbasin level. This approach is consistent with approaches used in at least five other regions around the state. Basin Plan Amendments have been prepared relying on this approach. The RWQCB still maintains the flexibilit to evaluate projects having unique site-specific conditions in the permitting process consistent with Items 2c and 2d of the Recycled Water Policy. Many of the suggested methods in the Coachella Valley SNMP, from volume-weighted averaging, contouring, layering, etc., are also applied in other SNMPs throughout California. In some areas of the Valley, a 20-year period may be appropriate while in others it may not. Therefore, the approach was revised. The approach now conducts an annual temporal filter, uses the most recent annual data point for each well, then filters spatially by grid cell for contouring and AWQ calculation.
MSWD	25	Section 2.2, Filtering: The temporal and spatial discussions are certainly informative but application of unfiltered and filtered datasets is not fully explained as they were at the stakeholde meeting. This is clear as to how the calculations are done but the reasoning seems to be short. Clustered wells may skew the results but the argument can be made that these clusters represer a management area important to the pumpers.	Filtering	Commented noted. Text is modified to reflect the comment. The Mission Creek Management Zone was reduced to reflect the area where data is present and the area most important for municipal supply. The reduced Mission Creek MZ for volume-weighted AWQ in Section 3.3.3.
MSWD	26	Section 2.2.1, Temporal Filter 1 – Frequency Bias: The section discusses nitrate concentrations indicating that between 1994 and 2009, levels do not exceed the MCL; however, after 2009, samples do exceed the MCL. It is inappropriate to apply a 20-year average when levels already exceed the MCL.	AWQ	Comment noted. The hypothetical case presented was intended as an example to illustrate the effects of filtering. This example was removed to avoid confusion.
MSWD	27	Section 3.3.2, Statistical Description of Ambient Water Quality, and Section 3.3.3, Volume Weighted Ambient Water Quality: Provide the methods used for data filtering together with explanations for methods used. For example, TDS (90% Confidence Interval for the Mean) in the Mission Creek Subbasin/Management Zone ranges from 466 to 547 mg/l for unfiltered while the filtered data ranges from 493 to 706 mg/l. The range of 270-1100 seems to be high and the standard deviation of 240 seems incorrect.	Statistical	The filtering methods are described in TM-1 and TM-2 (section 2.2, pages 7 and 8). Statistical methods, such as standard deviation are standard and not modified. Statistical results will be checked. Basic statistical methods are descried in the following: USGS, 2010. Statistical Methods in Water Resources, Techniques of Water-Resources Investigations of the United States Geological Survey, Book 4, Hydrologic Analysis and Interpretation.

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RWQCB	28	While we agree with the concept of separating the Basin into management zones (MZ) due to variations in water quality and/or geologic conditions, we do not agree with the number of proposed MZs or the methodology for determining AWQ conditions within each MZ. The resulting single concentration value to represent the water quality within an entire MZ for a particular constituent is of little value.	Management Zone	The Recycled Water Policy states that the plan is to be completed at a "basin/subbasin" level. The Implementation Strategies section of the SNMP will highlight areas of a management zones contributing the most to available assimilative capacity for future project consideration. The Regional Board still maintains the flexibility to evaluate projects having unique site-specific conditions in the permitting process consistent with Items 2c and 2d of the Recycled Water Policy. See also the response to comment no. 24.
RWQCB	29	We strongly believe that a more complex numeric modeling approach should be applied to each MZ that generates data driven concentration contours illustrating both horizontal and vertical variability for any given constituent, at any given location/time. This approach will allow the Distric to identify areas (subzones) within MZs that possess or lack assimilative capacity as it provides more accurate approximation of mean constituent concentrations.	Numerical Model	Comment noted. Numerical modeling would allow for incorporation of a comprehensive data history, although at significant cost and impact to project schedule. The Integrated Regional Water Resources Planning Group, for which the RWQCB was a part of, evaluated this issue and determined it was not feasible. For determination of the ambient water quality, a numerical model is used to leverage information on aquifer layer and hydraulic properties. A numerical model for planning would need calibration; this would pose more significant data adequacy problems than currently exist. Dynamic or long-term project evaluation with a numerical model would be useful, although not required. Non numerical modeling/methods have been used successfully for SNMPs throughout the state. Using a model for the ambient water quality will provide the same result as the volume weighted method. The spreadsheet model being developed for planning purposes is conservative and has been useful throughout the state. It is also important to note that this plan is likely a living document. As models are updated and calibrated they can be incorporated.
RWQCB	30	In short, the application of statistics to homogenize a heterogeneous groundwater basin is not appropriate. This is exemplified in TM-2, Table 3-5, which provides descriptive statistics used to determine the volume-weighted TDS AWQ for the East Valley MZ.	AWQ	Table 3-5 lists the filtered dataset for East Valley Management Zone. Statistics are provided for summary reference. Note that the mass of constituents is calculated for three separate vertical layers and then aggregated together. Using the groundwater flow model layering, well construction information, hydraulic properties from the groundwater flow model, and the filtered database, the aquifer heterogeneity is considered at the 1,000 by 1,000-foot horizontal scale and up to three vertical layers. The results of individual cells are then aggregated first by layer and then by management zone. This is consistent with the Recycled Water Policy that states salts and nutrients from all sources be managed on a basin-wide or watershed wide basis.
RWQCB	31	For the sake of transparency, please provide all data used for scientific interpretations (i.e., summaries of raw data, sampling locations, MZ and subzone delineation, sampling date, map, etc.) in an acceptable and usable format (digital or otherwise) in all future submittals, including th final versions of TM-1 and TM-2.	General	All data has been provided in electronic format to the RWQCB, these data have also been reviewed on two occasions with RWQCB staff and MWH staff at RWQCB offices. All data is presented in TM-2 as filtered and unfiltered for transparency. Please note the response to comment No. 1.
RWQCB	32	The use of water quality data collected from 1994 to 2013 for the calculation of AWQ is unacceptable particularly in the case of Coachella Valley because it blurs the effect of recent discharge/recharge activities.	Period	Based on feedback from stakeholders, the AWQ calculation method was revised. The current method determines the annual median for each well. Within each cell the yearly cell mean is calculated based on yearly well medians within the cell. This determines a value for each cell for each year. The most recent annual value for each cell is used, all values are less than 15 years old. Shortening this period of data used will reduce the data available for the AWQ calculation. An attachment has been included to provide an investigation of data adequacy or data "sufficiency" within the study area that includes an evaluation of different baseline periods and the effect on data adequacy. As noted, the filtering method has been modified to use the most recent yearly median available for each well, as opposed to the median of all data points over a chosen baseline period.

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RWQCB	33	The District's consultant (MWH) states there is insufficient recent data for statistical analysis if a 20-year data span is not utilized. If the District feels recent data (i.e., data collected in the last five years) is insufficient to develop a SNMP for the Coachella Valley Basin, then the District needs to collect more data.	Data	Please note response to comment No. 32. The reference to the approved 5-Year baseline period is in Policy under section 9.c.1, this subsection refers to groundwater recharge with recycled water, as opposed to irrigation that occurs in this region. The "5-year or approved" baseline is not applicable in this case, regardless, the stakeholders have and will continue to work with RWQCB staff to determine an applicable period. The revised AWQ is an example. The Policy makes reference to data needs and monitoring to improve available data for analysis in the form of a monitoring plan. The basin wide monitoring plan is to include an appropriate network of monitoring locations. The scale of the plan is dependent upon the site-specific conditions and "shall be adequate to provide a reasonable, cost-effective means of determining whether the concentrations of salt, nutrients, and other constituents of concern as identified in the salt and nutrient plans are consistent with applicable water quality objectives." Note the Policy does not accept a perfect data history for calculations. At this time, it would not be reasonable or cost-effective to install a monitoring network. A monitoring plan will be a part of the final SNMP with monitoring and implementation recommendations.
RWQCB	34	As a final note, while it is commendable the District has taken the initiative to develop a SNMP fo the Coachella Valley Basin, We are concerned with the absence or limited participation by other major stakeholders in the Technical Advisory Group. The Recycled Water Policy views this endeavor as locally driven and encourages the participation of all stakeholders.	Stakeholder	The Technical Advisory Group (CVWD, DWA, and IWA), that funds the plan and manages the consultant, has made it a primary emphasis to encourage stakeholders to participate. Four stakeholder meetings have been conducted, two more are planned, and others can be added if needed. All recycled water permittees, all wastewater agencies, all tribes, all water purveyors, and all golf courses have been invited. A website has been set up to publicly post deliverables, comments, and meeting information. Fifteen meetings have been conducted with RWQCB. It has been the intent of the Technical Advisory Group to manage a locally-driven SNMP. A list of stakeholders will be included in the SNMP.