JORDAN RIVER TMDL RESPONSES TO COMMENTS ON RECENT TECHNICAL MEMORANDA

Date: June 8, 2010

This document responds to comments received through May 19, 2010 by the Jordan River TMDL Technical Advisory Committee to the following technical memos:

Cirrus Ecological Solutions. 2009. Jordan River TMDL Phase II: DRAFT Technical Memo: Updated Pollutant Source Characterization. Logan, Utah.
Cirrus Ecological Solutions. 2009. Jordan River TMDL Phase II: DRAFT Technical Memo: Future Loads and TMDL Compliance Points. Logan, Utah.
Cirrus Ecological Solutions. 2010. Jordan River TMDL Phase II: DRAFT Technical Memo: Update to Linkage Analysis Related to Dissolved Oxygen in the Lower Jordan River, January 13, 2010
Cirrus Ecological Solutions. 2010. Jordan River TMDL Phase II: DRAFT Technical Memo: Critical Conditions, Endpoints, and Permissible Loads in the Jordan River. Logan, Utah.
Cirrus Ecological Solutions. 2010. Jordan River TMDL Phase II: DRAFT Technical Memo: Load Allocations for Pollutant Sources Contributing to Impairment of Dissolved Oxygen in the Jordan. Logan, Utah.

Table 1documents each comment and its associated response, including proposed changes to earlier technical memos. Table 2 lists the source of each comment, along with the commenter's name and affiliation. Table 3 provides a cross reference between the Comment Code and the document or subject referred to in the comment.

Table 1. Response to comments received on technical memos on Jordan TMDL as of March 11, 2010.

Commenter Type	Letter Number	Comment Number	Comment Resource Code	Comment	Response to Comment	Resultant Change to Document or Analysis
WWTP	1	1	TM1	"Page 8, Tables 5 and 6. The summary of UPDES point source loading references WE2 and states that the BOD values have been adjusted up to reflect Central Valley reporting CBOD data rather than BOD data. Since April 2005 South Valley WRF has also been reporting CBOD data in the monthly DMR reports. Our permit as well as the Central Valley's permit and the South Davis SID's permits were all renewed in 2005 as part of first round of the Jordan River TMDL. At that time the permits were modified to require that CBOD data be reported. Copies of South Valley's and Central Valley's discharge permits are included in appendix B of the Countywide Water Quality Stewardship Plan (WaQSP) where it shows the requirement to monitor CBOD to meet permit	Fresh sets of data for the period 2001-2008 were requested in 2009 from SVWRF, CVWRF, and SDSWWTP. The data from SVWRF are labeled as "CBOD," so BOD data collected by DWQ was used. The data set received from CVWRF is labeled "BOD5." The data received from SDSWWTP is labeled "Eff BOD."	No changes necessary.

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				requirements. (See the Specific Limitations and Self Monitoring section of the permit.) Prior to 2005 South Valley WRF, and I assume the other two facilities, reported BOD data on their DMR reports. You will have to contact Dal Wayment, the General Manager of South Davis SID, directly to determine what type of data has been reported for that facility, but I am reasonably sure it is also CBOD data." "The correction factor for South Valley has been calculated at 1.155. To convert CBOD to BOD multiply the CBOD concentration by 1.155."		
WWTP	1	2	TM2	"Table 2. These tables use average monthly BOD, TSS, and Ammonia values for SVWRF [and] are based upon the effluent characteristics from an Extended Aeration Treatment (Oxidation Ditch Configuration) facility. By the end of 2010, the SVWRF plant will be converted to a Plug Flow Nitrification Activated Sludge facility with fine bubble diffusers. The quality of the SVWRF effluent is expected to change with average effluent values of TSS ≈ 10 mg/l, BOD ≈ 10 mg/l and Ammonia ≈ 2 mg/l. The TMDL study needs to use these updated values for determining loads to the Jordan River as they reflect the effluent conditions for the majority of planning horizon. The new effluent values are well within current discharge limits."	"Table 2" refers to loads from tributaries. Assuming the comment actually refers to Table 4, loads from WWTPs, the effluent concentrations for the new technology described in this comment are higher than historic averages of TSS (mean 7.1), BOD (mean 3.2), and NH_4-N (mean 0.08). Lee Rawlings, in subsequent emails, confirmed that concentrations of these substances will likely increase and recommends using the new values for future loads.	Future concentrations were adjusted and loads recalculated for both SVWRF and JBWRF.
WWTP	1	3	TM2	"When the new JBWRF plant opens the initial flow (10 to 15 mgd) will be taken from flows that previously have been going to South Valley, thus transferring loading upstream in the Jordan River to the JBWRF discharge point near where Bangerter Highway crosses over the Jordan River. It does not appear at this time that the future	Original future loads analysis projected discharge in 2030 based on analyses in the WaQSP. For SVWRF it used 39 mgd, based on Alternative 7 (44.5 mgd) and Alternative 8 (34.5 mgd). For JBWRF it used 22.5 mgd, based on values shown for South Valley Sewer District (SVSD) for Alt 7	The new estimates of future flows of 34 mgd for SVWRF and 23 mgd for JBSWR are now considered more accurate. Table 4 and associated loading values will be adjusted to reflect the updated flow estimates.

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				loading calculations in this document reflect this relocation of treatment and discharge. This relocation will have significant effects on the loading contributed by South Valley WRF. For example, 10 mgd is approximately one third of our current flow. When/if this volume is transferred, along with splitting new growth with the JBWRF plant, it is doubtful that South Valley WRF will return to its current flows (34 mgd) during the planning horizon of this study." "The new plant is scheduled at the end of 2012 and, after opening, will treat the majority of new growth in the South Valley Sewer District service area. Table 2 estimates the flows in the combined service area at 56.7 mgd average daily flow. This volume will be split between the two treatment facilities. It is my understanding that JBWRF will have the capacity to control the volume they treat with the remaining untreated wastewater going to South Valley for treatment. With this capability it is difficult to predict the actual volumes to be treated at each facility but for calculations sake a reasonable split would be 60% to South Valley (34 mgd) and 40% to JBWRF (23 mgd). I believe these flows will give a reasonable estimate of the loadings from each facility for the year 2030, the difference being the location of discharge not the total volume treated by the two plants."	(22.5 mgd) and Alt 8 (22.5 mgd) in the WaQSP.	
WWTP	1	4	TM2	"Calculated loadings reported in tables 4 & 5 for JBWRF need to be modified to reflect the expected discharge loadings from the membrane treatment system currently being built. The membrane treatment system is extremely efficient at removing suspended solids and organics. As the plant is not in operation, the BOD, TSS, Ammonia and Total Phosphorus loading will have to be	Future concentrations from SVWRF were assumed to be: TDS 966 mg/L, TSS 7.1 mg/L, BOD 3.2 mg/L, NH4-N 0.08 mg/L, and TP 3.84 mg/L. Future concentrations from JBWRF were assumed to be: TDS 1,200 mg/L, TSS 25 mg/L, BOD 15 mg/L, NH4-N 4.5 mg/L, and TP 5 mg/L.	Future concentrations for SVWRF and JBWRF will be revised to reflect the new estimates for TSS, BOD, and NH4-N. Other concentrations will be left at current levels.

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				estimated. This type of treatment system is expected to be able to produce effluent that is better (lower levels of pollutants) than those of South Valley WRF. As a default value the pollutant concentrations from South Valley should be applied to the loading calculations for the JBWRF facility. While these concentrations are low compared to the other treatment plants the new membrane system should perform at or below these levels."		
WWTP	1	5	TM2	SVWRF is concerned about the lack of a compliance point between the Narrows and 2100 South. This is a large stretch of river which encompasses the discharge of three wastewater treatment plants, along with several other inflows and several outflows. With temperature being an impairment through the sections designated as cold water fisheries, perhaps another compliance station should be added at the downstream end of section 5, near 6800 South, where the coldwater fishery designation ends and the warm water fishery begins. Adding this station will provide benefit by; • Documenting compliance between the two types of fisheries. • Separating two of the treatment plants (JBWRF and SVWRF) from Central Valley WRF, making it easier to monitor the effects of effluent discharge into the river. • Providing a monitoring point for E. coli levels which will be addressed in a future TMDL.	The transition from Class 3A (cold water fishery) to Class 3B (warm water fishery) occurs at the confluence of Little Cottonwood Canyon, just 2.5 miles below 5400 South. The data set for 5400 is not robust but, although not a compliance point, WQ could continue to be monitored at 5400 South, which is close to this transition point. Data from this station would help resolve the WQ conditions at a finer resolution such that, if necessary in the future, a new compliance point could be created.	A new compliance point at 5400 South should be considered in the future as more data becomes available.
WWTP	1	6	TM2	"The WaQSP document was researched and created looking at the years around 2005 during which time the county was experiencing an unprecedented amount of growth. During this time public entities were scrambling to meet the	No better estimates are available. Economic cycles will ebb and flow, with some future cycles perhaps even more extreme.	No changes necessary.

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				growths being projected for the coming decades. However, these projections are based on a time of extremely high growth and but growth has slowed down considerably. With the economic slowdown now having lasted a year, and being forecasted to continue for several more, perhaps it would be prudent to revisit the growth projections for the county."		
Government	2	7	TM2	"Future Loads 2.2.4 (pg. 9)-In terms of development and stormwater on the west Bench. I thought earlier this year Kennecott Lands pulled their master plan and suspended development indefinitely for the west bench. Also, it was planned for 100% stormwater containment. How will this affect the TMDL?"	Suspended development plans may indicate a slower population growth than originally forecast. How long this will last and whether other, faster growth rates will occur is unknown.	No changes necessary.
Government	3	8	TM2	The Technical Memo calculates loads by multiplying monthly average concentrations by monthly average flows to calculate total monthly loads. In many cases, the underlying values are not paired values (taken simultaneously). However, "The average of the products is not the same as the product of the averages…" There has been no effort to assess how much error there might be in the approach taken compared with a sum of instantaneous products of concentration and flow. While it is not possible to create the missing historical data, it is possible to assess the error that may result from using the products of monthly averages for some stations and some pollutants. One test could take advantage of the frequent measurements of specific conductance (Ksc) and the close relationship between Ksc and TDS and compare the sum of the loads calculated from these values with the loads calculated from occasional measurements of TDS. This might help readers to evaluate the error associated with the	Frequent (daily) flow data is not available for all stations and even single monthly concentration values are not available for all months and all years. In fact, in most cases, only a few measurements are available for individual months over the 14 year period of record. Different pollutants and sources also have very different patterns. Some may change relatively slowly and some more rapidly. And pollutants differ in their year-to-year patterns. The only parameter which might be tested is TDS, but it is uncertain how a potential error calculated for TDS might apply to the other pollutants. Synoptic data has only been collected for a few days in a few months. This may not be any better than using monthly averages.	No changes necessary until additional data series are available.

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				calculated loads. A second test could compare loads calculated from paired measurements during synoptic monitoring with loads calculated from monthly averages.		
Government	3	9	TM2	"A second technical concern is about the method used for censored NH_4-N data . A very strong argument is made in Helsel (2006) against substituting a fraction of the detection limit for calculation of parametric statistics, like the mean. Methods are generally available that can improve the estimate of a mean. I recommend that these kinds of methods be used for estimating monthly means for NH4-N, particularly because the mean is central to the method chosen to calculate annual loads. It was not clear to me if this kind of substitution was used for any other parameter."	Two issues arose with NH4-N data. First, data from several years was excised from the data set when it was discovered that the equipment used was giving false measurements and there was no reliable way to adjust them. Second, values for samples that were below detection limits were assigned one half of the minimum detection limit. The analysis in the recommended citation (Helsel 2006) has been considered in previous TMDLs. The error introduced by using one half of the minimum detectable limit is most profound when most of the values are just above the minimum detection limit. In the case of WQ measurements in the Jordan River, most measured values are far above the minimum detectable limit and so the error introduced by using one half of that value is far less significant than other sources of error (timing, season, laboratory variability, etc.).	No changes necessary.
Government	3	10	TM1	P. 5, line 3: "data" is plural, so the sentence here should have "were" rather than "was." This applies to the use of "data" throughout the report.	Both styles are used in scientific and technical literature. DWQ prefers the following test: when the word "facts" can be substituted for "data" use it as a plural noun, when "information" can be substituted, use it as a singular noun.	The use of "data" will be reviewed in all technical memos and edited accordingly.
Government	3	11	TM1	P. 5, line 17: It is not clear if "increasing size" refers to physical dimensions or to discharge.	It refers to length. Longer reaches of the river are probably more accurate because they are anchored by stations where flow data was measured continuously. They also let any natural variances in errors offset each other to a greater degree.	Text will be revised for clarity.
Government	3	12	TM1	p. 5, line 21: The Narrows should be indicated on	The Narrows occurs at the junction between	This landmark is very important and referred to

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				figure 1.	Segments 7 and 8.	often. The figure will be revised.
Government	3	13	TM1	p. 6, line 11: Again, see Helsel (2006).		See response to Comment 9 above. No changes necessary.
Government	3	14	TM1	p. 8, Table 4: Values for NH4-N could differ from these percentages if Helsel (2006) methods were used.		See response to Comment 9 above. No changes necessary.
Government	3	15	TM2	p. 12, line 9: Reference should be to table 9, not 8.	Error in text.	Reference will be corrected.
Government	3	16	TM2	p. 13, line 10, below table 9: I don't think you have defined error rates.	Refers to errors between calculated and measured values in the Mass Balance table.	Rewrite for clarity.
Organization	4	17	TM1	"The major comment we would like to make is that there will soon be a need to consider impacts to the River at the end of the Jordan River TMDL and to the areas served by the Surplus Canal. As we understand it the next Jordan River Technical Advisory Committee meeting will likely be examining possible load limits in order to meet the standards that are out of compliance. While this is a good step, it is very difficult to see how this can be done if the downstream components are not addressed. Members of the conservation community asked for this type of detail in a letter on the Jordan River TMDL Work Element 2 dated March 23, 2009." "As stated by some of us in a letter on March 23 regarding Work Element 2: 'We request creation of a stakeholders work group, or subcommittee, to discuss nutrients on the lower Jordan River watershed, including Farmington Bay. A fully informed discussion of the nutrient needs beyond the current scope of the Jordan River TMDL should be necessary before any regulatory decisions regarding nutrients are made for the current Jordan River TMDL study area.' If this	Developing a load allocation to achieve WQ standards in the Jordan River does not preclude revisiting those standards if, in the future, downstream uses require further improvements to the quality of the outflow from the lower Jordan River. It may be inefficient not to consider the entire watershed at once, but doing so may delay improvements to Jordan River water quality for a substantial time. It appears that this Jordan River TMDL is being undertaken in isolation, but it is sometimes necessary to take on problems of smaller scale than an entire watershed to make progress.	No changes necessary.

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				type of discussion does not occur, at the minimum we strongly believe specific details and commitment on how these issues will be addressed in the future should be provided before specific decisions on the Jordan River TMDL are discussed."		
Organization	4	18	TM1	"As discussed at the Jordan River TMDL Technical Advisory Committee meeting on Dec. 15, the Surplus Canal and the areas that the Surplus Canal provides water to should be provided on any maps in the Jordan River TMDL. Also, maps should show a continuation of the Jordan River or that the river flows into wetlands at the most northern point of the Jordan River TMDL. "	Surplus Canal is a major landmark and should be added to figures. The watershed of the Jordan River at its terminus was kept graphically simple on purpose. It may be possible, however, to represent the wetlands with some other color that would not detract from the figure.	All maps will be edited to show the Surplus Canal and wetlands below Burton Dam, if available.
Organization	4	19	TMDL	"Water quantity: Diversion of water that results in reduced flows to wetlands surrounding the Great Salt Lake is the biggest liability to their welfare. Methods used to address TMDL issues should identify a no net loss to wetlands and the Great Salt Lake from reduced flows in the Jordan River."	Changes in water rights allocations are typically beyond the scope of a TMDL and the Jordan River is fully allocated. However, flows are a key component of determining loads—and load reductions, and flows have a direct effect on physical processes such as reaeration. This will also apply to water quality downstream of the terminus of the Jordan River.	Changes to flows are not within the scope of this TMDL.
Organization	4	20	TM1	"Are the identified constituents causing impairment in the Jordan River TMDL properly averaged, e.g., does the data as averaged represent the real situation? Have values presented been normalized to represent diurnal fluctuations where fluctuations are expected to exist?"	The question of how to use occasional measurements to determine loads for longer periods has received extensive discussion. Data are very limited, however and, although the methods used may be less than perfectly accurate, there may be no better or more valid alternatives. Diurnal fluctuations are particularly relevant for DO, affected as they are by the result of photosynthesis processes. These diurnal fluctuations have been accommodated by the selection of endpoints that take into account the sag in DO from the time of day when it is	No changes necessary.

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					measured to the time of day of the minimum. See the technical memo on permissible loads.	
Organization	4	21	TM1	"[O]n page 6 of the Pollutant Source Characterization document, it states that the WWTP loads were changes from calculations based on maximum flows to average daily flows. At the December 15 meeting, the consultant stated that this change reduced estimates of their load contributions by 20 percent. We request an explanation of how this change can reflect critical conditions as required by the federal TMDL regulations (usually low flow/high discharge for point source problems)."	This change corrected an error where maximum daily flows were paired with average daily concentrations. Where data is not available on a fine temporal scale (continuously or by minute or hour) calculating total loads over longer periods, such as days or months, can use average flows and concentrations.	Evaluate whether data is available to assess sub-diel patterns of flow and concentration.
Organization	4	22	TMDL	"Data as averaged to calculate load should be for matched flow data e.g. collected concurrently. It was indicated at the December 15 meeting that flow data was used from a longer period of collection than for the concentration data in calculating loads. (There appeared to be some concurrence at the meeting that inaccuracies would be built in. We assume this is particularly true for monitoring points where discharges are combined with other river flows, which varied substantially between a series of wet years and a series of dry years. WWTP dischargers may be more consistent as long as the technology remains the same.)"	Where future load allocations are based on monthly averages of historical flows and concentrations, it is important to use reference periods that give the most accurate representation of long term conditions. A longer period was used for flow (1980-2005) to take into account long cycles of precipitation and water availability. WQ concentrations are expected to have changed more than flows, so a shorter period of historical record (195-2008) is expected to better represent current conditions from which the future is projected. Of note, an even shorter period of 2001-2008 was used for WWTPs to better represent the influence of current population and technology.	No changes necessary.
Organization	4	23	TM2	"[C]harts on pages 4-6 and narrative discussions on later pages appear to miss some key issues related to increased impervious surfaces and water quality/quantity. Generally the charts state that increased imperviousness will increase stormwater discharges to canals, tributaries, and the river. What does not appear to be acknowledged is that those flows will be much more "peaky" as a result	Increased peak flows would be expected to decrease groundwater infiltration. However, the larger impact on groundwater infiltration would come from increased serviced area being routed directly to stormwater drains, rather than being allowed to flow as diffuse runoff. Other effects of higher flows would include increased streambank erosion, soil transport, and resuspension, and	No changes necessary.

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				– water will rush off the impervious surfaces faster AND it will be less likely to infiltrate to the groundwater, reducing groundwater discharge to the river/canals. We request the final report address what the changes in flow regime will mean for loading calculations." "Page 7 of the TMDL Compliance Points document has a perfect example of the over generalization of the impervious surface/flow changes. It states that runoff from stormwater will increase in the tributaries, while surface infiltration to groundwater will decrease so discharge to the tributaries from groundwater will reduce and the 'two processes will largely offset each other.' This does not take into account changes in flow timing and the quantities (which can at storm peaks cause physical problems that will also hurt your chemical water quality). We again request that the final report address the real changes in flow regime resulting from increased impervious surfaces, and what those changes mean for load calculations."	increased TSS, BOD, and TP. On the other hand, less water entering the Jordan River via groundwater flows would reduce TDS. As described in TM2, future loads from stormwater have accounted for the increased amount of impervious surface area (and changes to flow regime) by increasing the percent serviced area within each catchment to 100 percent. Reduced groundwater flows as a result of increased stormwater serviced area have not been modeled, but this could possibly be added to future analyses.	
Organization	4	24	TM2	"Data do not represent end of the river as defined by the map and narrative. Discussion in the last paragraph (page 23) of the 'Future Load…' document indicates that low DO in the State Canal is a reason for not including data from the lowest end of segment 1. Currently the State Canal is also protected for DO under criteria 3d. It seems important to include data from the lowest point of the most downstream segment of the Jordan River as this represents the contribution to the State Canal."	The State Canal is not listed as impaired for any parameter. The monitoring point labeled as "Jordan River at State Canal Road Crossing" is located more than a mile from the confluence with the Jordan River and the uniform nature of the canal is considered to allow for stratified and relatively unmixed conditions which are not representative of the Jordan River. The lowest downstream station with a relatively robust data set is Cudahy Lane, and river characteristics below Cudahy Lane are thought to be similar enough so that achieving WQ standards at Cudahy Lane will be sufficiently protective of these downstream portions. The loading alternatives assessed with the QUAL2Kw	No changes necessary.

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					model did evaluate DO conditions all the way to Burton Dam at the true bottom of Segment 1.	
Organization	4	25		"Do current data include a relatively new area of development/buildout of residential and some business adjacent to the River downstream of the Cudahy Lane compliance point?"	Has there actually been development adjacent to the Jordan River below Cudahy Lane? There has been development north of I-15 but east of Legacy Highway, and this area has developed very quickly since the TMDL process was begun. However, most of the extra load associated with this development should be included in the recent discharge from SDSWWTP and population projections that affect WWTP discharge.	No changes necessary.
Organization	4	26		"Were mercury concentrations collected using ultra low techniques and evaluated using ecologically relevant concentrations rather than the much higher drinking water concentration? Very few sites have adequate data for UDWQ to evaluate compliance with the aquatic life standard of 0.012 UG/L. Health warnings have been issued regarding the consumption of waterfowl due to samples collected in the Farmington Bay area."	Mercury was not a pollutant analyzed in this TMDL because the Jordan River is not listed for mercury and mercury is not linked to any of the river's impairments.	No changes necessary.
Organization	4	27		"Were loads for selenium calculated using data from UDWQ data analyzed only using data collected after about 1995/6? (More details regarding this question: Splits analyzed by UDWQ State Lab of water from the seeps from the recently replaced Vernal Wastewater Treatment Facility did not match those splits analyzed by USGS and a local private Laboratory and it was found that the State Lab data was erroneous. It is believed procedures were improved and more recent selenium data is accurate. State data used in any evaluation for the Jordan River prior to this time is unreliable.)"	Selenium was not a pollutant analyzed in this TMDL because the Jordan River is not listed for selenium and selenium is not linked to any of the river's impairments.	No changes necessary.
Organization	4	28		The following comments/questions relate to the	All good questions and observations. These should	No changes necessary.

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				issues of concern that are downstream from the Jordan River as currently defined for the purposes of the TMDL. a. Water quality: Water quality delivered to wetlands needs to support at a minimum reasonably good quality habitat for wetland dependent wildlife in a sustainable manner. No net loss of wetlands due to poor water quality over time should be a minimum goal. A preferred goal would to improve the water quality to existing numeric standards. b. What safety factors will be used when considering the impact to downstream sites, in this case freshwater wetlands, to assure they are not impaired? What is the basis for determining minimum DO for wetlands? What are the standards being applied to these wetlands? Do the draft standards for Rule 317-2 currently open for public comment reflect this? Are these freshwater wetlands healthy, e.g. abundant and diverse species of invertebrates? Do these wetlands support all life stages of warm water fish? Are algal blooms a physical hazard to newly hatched ducklings? Do they contribute to predation losses? Are the algal blooms toxic? Can the ducklings find adequate food in areas choked with algae? c. What pollutant loads do and/or would result in a negative impact to the open water of Farmington Bay? d. Are the areas of algal blooms getting worse, e.g. growing in extent, depth and mass? Are these areas being filled with sediment, contaminated with metals, or otherwise progressively destroyed as a result of nutrient loads and cycling of algal biomass, sedimentation, or accumulation of elements simply because they act as a final treatment pond, even if elements are within	be incorporated into WQ considerations for wetlands and water bodies downstream of the terminus of the Jordan River.	

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				concentrations for respective standards? e. Has mercury been evaluated for areas of extensive algal blooms? Recent research indicates a strong relationship between the diurnal oxygen concentrations, pH and inorganic mercury concentrations. Naftz et al. 2009. f. Selenium is bioaccumulative. Has this been evaluated relative to downstream uses? g. Is the River a source of ecologically relevant concentrations of mercury to the wetlands downstream?		
University	5	29	TM1	"This document shows a significant increase in both BOD5 and ammonia loadings to the river, suggesting that the initial oxygen demand was underestimated both from a carbonaceous oxygen demand as well as a nitrogenous oxygen demand. The much higher ammonia loading and questions regarding the ammonia data mass balance begs the question again as to the importance of the oxygen demand from this chemical. The additional data that were to be collected regarding nitrification potential and nitrogenous oxygen demand that were alluded to at the workshop, and that were briefly mentioned at the end of this report as "…ongoing research on SOD and species of algae present in the Jordan River…" were not found in the document, and would be very useful in addressing the question of the importance of this nitrification reaction to the overall oxygen balance in the Jordan River. This may be a totally moot point based on the updated BOD5 loading numbers that have been increased from 1,333 T/yr to 2,371 T/yr (548 T/yr to 943 T/yr in Segment 4 upstream of the DO impaired segments). With this nearly doubling of BOD into Segment 4, primarily from Central Valley, the impact on downstream	The increases were the result of correction of errors—specifically data wrongly represented as BOD in the past and eliminating very low NH_4-N values that were found to be unreliable. As a result, the linkage between BOD (organic matter) and low DO is even stronger than before. Studies are under way to measure the characteristics of BOD—fast, slow, and nitrogenous.	No changes necessary.

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				oxygen balance would be expected to be significant, making any additional oxygen demand from ammonia loading relatively unimportant. I expect some discussion of this, perhaps following additional model calibration, will be forthcoming, and I look forward to reviewing that discussion."		
University	5	29	TM2	"Page 14 – the 18% increase in the ammonia loading that is supposed to show up in Table 4 for SVWRF does not when comparing the values in Table 5 for the Updated Loads memo to the values in Table 4 in the Future Loads memo. The future ammonia load should be 5 rather than 4 T/yr from my calculations. The other numbers in the table seem to be correct. Other than this minor comment, the future loads calculations and compliance points memo seems straight forward and comprehensive."	This is due to rounding error. The value in the Updated Loads technical memo was actually less than 4.0, and when increased for future conditions was less than 4.5 making it appear that it did not change when in fact it did increase.	No changes necessary.
University	5	30	TM2	"I did not see results of the algae study, the SOD study, nor of the BOD rate and carbonaceous/nitrogenous demand composition study that were to have been carried out this past summer. Are there other documents that can be reviewed detailing the results and conclusions of these analyses? It seems that the findings of these studies, regarding the rate of oxygen uptake based on BOD inputs from various sources throughout the river segments, and the impact of nitrification versus carbon oxidation, would facilitate enhanced model calibration, and put to rest once and for all the question I have had regarding the importance of ammonia loading to the Jordan River. I look forward to reviewing these study data and to provide any further comments I can on them as appropriate."	The results from the SOD and algae studies are incorporated into the updated linkage analysis. The BOD rate studies have not been completed yet.	No changes necessary.
Government	6	31	TM3	"It was not clear if the samples in Fig. 2 represent	Grab samples.	Clarify text.

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				a whole cross section of the stream or if they are grab samples. It would help to specify what they represent."		
Government	6	32	TM3	"In section 5.0, the data are there to support the conclusion, but I found the argument hard to follow. I would suggest some re-writing there."		Consider editing to clarify.
WWTP	7	33	TM3	"When looking at algae concentrations along the Jordan River and trying to derive their source(s) it appears that the studies show a majority of the algae is coming from Utah Lake. A potential source of algae that has not been considered is the wastewater treatment plants themselves. Significant amounts of pelagic and especially benthic algae grow in trickling filters, clarifiers, and on surfaces of mechanisms, channels and contact basins."	This shows up in VSS loads and the recognition that VSS from WWTPs is a significant load to organic matter which has a significant effect on DO. Significant reductions in this VSS are being proposed for WWTPs.	No changes necessary.
WWTP	7	34	TM3	"I would like to see a response from the two professors discussing their interpretation on how the information in the other study supports, sheds additional light, or rejects the findings of their report. In short if the two reports are put together, what do they mean? One of the committee members brought up a question about the BOD of nitrogen compounds not being measured or monitored and reported. I agree with him that the oxidation of ammonia to nitrate will consume significant amounts of oxygen from the water. However the majority of the total nitrogen being discharged from the wastewater treatment plants is in the form of nitrate which has a much, much lower BOD. Yes nitrate is a nutrient and can aid in the biological oxidation of food but it has already been converted from ammonia to nitrogen which, of the two processes, consumes the greater amount of oxygen. In the wastewater field the accepted	This assessment shows up in the modeling work in the permissible loads technical memo where it was found that neither reducing nutrients nor NH4 have a significant effect on DO.	No changes necessary.

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				method of measuring the BOD of nitrogen compounds is to measure the difference between the BOD (biochemical oxygen demand) and CBOD (carbonaceous biochemical oxygen demand) test. The difference between the two is the amount of BOD that results from nitrogen compounds. If this continues to be a concern perhaps in future sampling and analysis both tests could be run."		
Organization	8	35	TM3	"Some Figures presented in the presentation as well on one occasion in the Update were confusing as presented - with tributary and mainstem data mixed. I suggest that bars for the mainstem be a different pattern than tributaries, or modified otherwise as needed, so that the reviewer can easily track the change in the river."	We used different colors, but we should consider different patterns as a significant number of people cannot distinguish changes in color.	Revise charts as necessary.
Organization	8	36	TM3	"It was pointed out that Figure 3 of Update had low numbers of samples for some sites. This should somehow be discussed or shown in this Figure as well as elsewhere where interpretation is potentially compromised."	The larger concern is the variability in the data. This is shown in the error bars.	Consider text to make it clear how few data points are available for some charts.
Organization	8	37	TM3	"Somewhat related, are the diurnal data for DO robust, or weak for non-daytime periods?"	Diurnal data are recorded at least hourly and sometimes every 15 minutes, so data for any measured site is usually "robust." However, diurnal data has not been recorded at all sites.	No changes necessary.
Organization	8	38	TM3	"On page 12 of the Update, the next to last paragraph above the discussion, it was speculated that suspended dead algae was the cause of the limited light below 2100 South on the Jordan River. It seems that the logic needs to further examined, or conversely, why are the middle and upper Jordan River not light limited by the same suspended algae?"	This is further discussed in the presentation of QUAL2Kw findings and load allocation technical memo.	No changes necessary.

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Organization	8	39	TM3	"The role of wastewater treatment facility effluents needs to be further discussed and analyzed as to their role as sources of nutrients. I understand defensive feelings, but there appear to be too many coincidences associated with the locations of these effluents and other findings that still need to be explained and evaluated."	This is further discussed in the presentation of QUAL2Kw findings and load allocation technical memo.	No changes necessary.
Organization	8	40	TM3	"I still remember mass discharges virtually raw sewage being dumped from the Central Valley WWTP in about 2002. My recollection is that there was 30,000,000 gallons dumped in the river due to a fire. Where did this go? What has been done to prevent these emergencies in the future? How does the TMDL process address these sources?"	The analysis relies on monthly averages. These incidents will have an impact on factors affected by settling material, such as SOD. However, the effects on long term averages (1995-2008) are likely very small.	No changes necessary.
Government	9	41	TM4	"Just to be clear, there is no provision in EPA's TMDL approval process for approving site-specific criteria or approving TMDLs written to targets that are not as stringent as the applicable water quality standards. Hence, EPA may not approve TMDLs that do not ensure attainment of currently approved water quality standards. Development of site-specific standards needs to proceed following UDWQ's process in coordination with EPA R8's Water Quality Standards Program. If during the TMDL development it becomes clear that site-specific standards are appropriate, there are two routes that one can take. First, a TMDL may be written for the standards that are currently approved and the TMDL may be submitted to EPA for approval. Once the site-specific standards are approved by EPA, the TMDL can be updated to reflect attainment of the new standards and the updated TMDL may be submitted to EPA for approval. Or, the process for establishing site-specific	A subsequent conference call between DWQ, Cirrus, and EPA discussed this issue. The Technical Memo was written to test whether it was possible to meet the WQ standards for TDS, temperature, and DO. The outcome from the call was an alternative to decouple the three impairments, continue working toward load allocations for organic matter that causes low DO, and complete the process for site-specific criteria for some segments of the Jordan River for TDS and temperature.	The Technical Memo will be revised to clarify the direction the State will be taking.

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				standards may be completed and once the standards are EPA approved, the TMDL may be submitted to EPA for approval." "We would ask for clarification in the technical memo document regarding this point so that the reader understands that approval of TMDLs based upon new standards can not proceed until those standards are approved."		
Government	9	42	TM4	"Regarding the need for site-specific criteria for TDS we offer the following information to assist in criteria development. There are two common approaches to developing site-specific criteria that use ambient data and these include ambient-based criteria (criteria set to protect the current condition; high concentrations due to natural sources) and attainability-based criteria (criteria set to the highest attainable condition, which includes feasible improvements)."	Some combination of these approaches will probably be necessary. In some segments there are no anthropogenic sources. In Segments 5 and 6, however, although it may not be possible to achieve the established WQ standard for irrigation uses, it may be possible to reduce irrigation return flow and diffuse runoff from tributaries enough to achieve the same criteria set for upstream segments.	EPA-referenced methods will be used to establish a process for setting site-specific criteria.
Government	9	43	TM4	"The site-specific temperature issue is a bit more complicated. It appears that either the impaired section of the Jordan River is: 1) miss-classified (warm segment that is classified cold, this is possible since the cold water segment is between two warm water segments) or, if the cold water aquatic life is an existing use; 2) a site-specific criterion may be warranted. If UT decides to pursue a site-specific criterion, the ambient-based or attainability-based approaches described above could be appropriate, or the criterion could be set to a value that will be protective of the existing aquatic life use. For example, Colorado invested a substantial effort into developing new temperature criteria that include both acute (daily maximum) and chronic (weekly average temperature) criteria, as well as seasonal criteria to protect reproduction	A combination of these approaches will probably be used. Some adult stages of "cold water species" are known to survive in Segments 5, 6, and 7. These uses may be able to tolerate temperatures higher than 20 °C, so the establishment of a new sub-use class with a new temperature criterion may be appropriate.	EPA-referenced methods will be used to establish a process for setting site-specific criteria.

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				for cold water species of interest. The acute criteria for cold water range from 21.2 C- 23.8 C . These criteria suggest that UT's existing cold-water temperature criterion (20 degrees C maximum) may be overly conservative depending upon the cold water species that occur at the site. If it is determined that the segment is miss-classified, a UAA would need to be developed to support the use change since the change would be from a cold water to a warm water use which has less stringent criteria. See attached letter on UAA requirements."		
Government	9	44	TM4	"There are a few other items of note regarding temperature we would call to your attention. First, the temperature criterion is a not exceed value; however, the comparisons made to the standard used mean temperature values rather than the maximum value. Second, based on the information provided in the document it is not clear how it was determined that temperature could be improved by 1 degree C. We would ask for correction and/or clarification on these points."	It is unknown how much improvement to either shading or WWTP discharge could be reasonably achieved. This analysis was designed to make the point that even a very aggressive approach would probably not achieve the WQ standard for temperature and some site-specific criterion analysis would probably be required.	Text should be clarified.
Government	9	45	TM4	"If VSS is found to be the major contributor of low dissolved oxygen in the Jordan based (sic), it will be important to determine the source and cause of the excess VSS components (SOD, detritus, ISS, and algae) and develop the linkage to a pollutant or causative agent of concern if appropriate for TMDL development. For example, based on Figure 16, it is clear that the upper segments of the Jordan including Utah Lake exhibit periods with algal productivity in the hypereutrophic range. If a major contributor to VSS in the Jordan is live and dead algae discharged from Utah Lake, it will be important to determine what is contributing to production of the excess algae in that system. We recognize that UDWQ is working toward	The next technical memo builds on the findings regarding organic matter and, although there is only minimal direct data on VSS, a reasonable set of assumptions is possible that can establish some tentative load allocations. Continued sensitivity to downstream uses and assessment of upstream sources will be required.	Addressed in final technical memo on VSS load allocations.

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				understanding these linkages and we look forward to the further elaboration of potential sources/causes of excess VSS loads into the Jordan in future documents."		
Government	10	46	TM4	"I have one general comment after going through the draft memo that may raise a concern. Because the TMDL process is now at a point where specific reaches and loads are being identified that may need controls or reduction of loads from water-user, I think the level of uncertainty about inputs to the Jordan may be too great to make decisions that will require actions by water users."	More data would be preferred and the State is continuing to refine and augment its data collection programs, however, the Jordan River TMDL effort has more data available than many TMDLs. Inasmuch as adaptive implementation may be required to achieve corrections to loading, a preliminary load allocation is still a reasonable goal.	No changes necessary.
Government	10	47	TM4	"This goes back to comments I made on the first technical memorandum relating to the methods used in the loading analysis. I still think that modeled results need to be compared to synoptic data, but that the synoptic data should be at a greater level of detail to define groundwater and irrigation-return inflows and their associated loading. I think this level of testing is needed to reduce possibility of asking stakeholders to control loading in ways that might be unnecessary or else insufficient."	The models were calibrated and validated using four synoptic events. Groundwater is still not well understood, however, and additional data gathering on groundwater quality as well as flows is underway to improve the model results.	No changes necessary; DWQ will continue to give attention to data needs, including for ground water quality.
Government	10	48	TM4	"p. 1, 3rd paragraph: 'This data was' 'These data were' I noted that data is treated as a plural noun and as a singular noun in the text. It should consistently be plural. Along with this, 'minimums' and 'maximums' should be minima and maxima."	DWQ format will be used for all technical memos.	Text will be revised. See comments above.
Government	10	49	TM4	"p. 1, last paragraph: Reference to 'upper segments of the Jordan River above 2100 South' could be misleading. These segments are upper and lower based on north/south, but would be lower/upper based on topography and streamflow. I would	Yes.	Text will be revised to use "upstream" and "downstream."

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				suggest consistently using 'upstream' and 'downstream' as references to get away for implication of elevation, such as 'segments of the Jordan River downstream from 2100 South.'"		
Government	10	50	TM4	"p. 3, paragraph 3: Although the description of TDS as a conservative pollutant could be right, it brushes over a lot of physical and chemical processes that could make it 'reactive' rather than conservative. I would suggest 'mostly a conservative pollutant' or something else to qualify it for this report."	Yes.	Text will be revised as recommended.
Government	10	51	TM4	"p. 17: 'are improving' 'improve'" "Table 8: As was noted in our discussions on 3 March, the exceedances in the last column were not added into discussion."	Yes.	Text will be revised as recommended.
Government	10	52	TM4	"p. 20, paragraph 3: Despite the fact that a temperature of 22 degrees for the SVWRF discharge exceeds the standard, it actually would have the effect of decreasing the river temperature during critical months. This might be mentioned."	True, but it would still be above the State WQ standard. It may be moot, as there may not be a reasonable way to reduce effluent temperatures during the heat of summer.	No changes necessary.
Government	10	53	TM4	"p. 21: Again just a reminder from our discussion on 3 March. The thermal discharge near the Bangerter Highway should be included in the considerations of impacts on temperature. A second thought on temperature. I would think that the temperatures that have been observed, although they exceed criteria for general classifications, must be 'acceptable' to the indigenous species. That should be a reason to support site-specific criteria."	No documentation was available for the earlier analyses.	This source will be investigated. Further assessment will be made of which species and age-classes are currently using these segments.
Government	10	54	TM4	"p. 27, next to last paragraph: Just a note that these	Text will be edited to make clear the significant of	Text will be revised.

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				are perhaps the first comparisons of the model based on the long-term data base to the synoptic monitoring. I think this is useful and critical. The message of figure 15 is not clear: the recent measurements are all above the long-term measurement averages."	Figure 15, to wit: individual years may vary significantly from long term averages. Even the 2004 DO measurements, although lower than during the August synoptic monitoring, were higher than the long term average.	
Government	10	55	TM4	"p. 29: I think it is very good to acknowledge the problem arising from diurnal cycling of DO and that the general sampling for the data base does not catch the minima for DO. Again, this could be a very critical aspect that should be resolved before stakeholders are asked to make changes."	The State is aware of this discrepancy and is taking steps to monitor DO during critical times.	No changes necessary.
Government	10	56	TM4	"Table 15: It strikes me that every month will require reductions; even a 50 percent reduction in January. In those months without irrigation return flow or substantial storm runoff, where will the reductions come from to meet the standards? Is this an argument for some site-specific criteria?"	Reductions will be proposed in the next Technical Memo.	Refer to final technical memo on load allocations.
Government	10	57	TM4	"Tables 15 and 16: Suggest you remove the average for permissible TSS in table 16 as you have in table 15."	Table will be revised as recommended.	Text will be revised.
Government	10	58	TM4	"p. 37. paragraph 4: Admitting that I have a very particular view of the detail and data needed to understand loads, I am struck that this conclusion suggests that the "tracer-study" level of detail might be needed. That takes me back to my comments on the first two technical memos about the method of calculating loads."	A tracer study is under consideration.	No changes to previous technical memos necessary.
Government	11	59	TM4	"1.2.2 TEMPERATURE: p.3, second paragraph: the wording seems a bit awkward…"	There may be some confusion between the physiological effects of too-warm water from the effects on DO.	Text will be revised for clarity.
Government	11	60	TM4	"1.3.2 ENDPOINTS: fourth sentence: replace	Noted.	Text will be revised for clarity.

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				'good' water quality with 'appropriate' or 'applicable' (good has no specific value)" "second paragraph, first sentence: eliminate 'where possible' (water quality standards SHALL be met, as per current regulations)"		
Government	11	61	TM4	"2.2.3.5 Segment 4: p.17, last sentence: replace 'should be removed' with 'could be removed.'"	If it truly is not impaired, then it cannot be on the 303(d) list.	No changes necessary.
Government	11	62	TM4	"4.1.3 RESULTS: p.26, second paragraph: If appropriate, specifically identify the large source of NH_4-N."	It would be appropriate; the source is CVWRF.	Revise text.
Government	11	63	TM4	"With South Valley Water Reclamation Facility being an oxidation ditch process, it is unlikely that its effluent could be cooled more than it already is by the process itself. However, OVER oxygenation could be possible as an additional source of dissolved oxygen (if the economic trade off is acceptable)."	Temperature reductions were included to help establish what might be possible. Over-oxidation can also be harmful to fish. The QUAL2Kw model may help assess whether hyper-aerobic conditions created at SVWRF would actually help impaired segments, either directly, or by providing the DO needed for organic matter decomposition in the middle segments.	No changes necessary. Further analysis and new text will accompany site-specific criteria.
Government	11	64	TM4	"Another possible additional source of oxygen would be to install stair step and/or turbulent channels on the sides of the river where grade and/or bank conditions allow."	These strategies could be further evaluated with the QUAL2Kw model.	No changes necessary in earlier technical memos. Additional analyses could include these options.
Government	12	65	TM4	"I agree with the assessment in this document that more data is necessary. This data collection needs to happen before there are any limits imposed on river discharges. Any changes in water quality from dischargers mid stream are going to be expensive, difficult to achieve, and may not accomplish the desired improvements."	More data would be preferred and the State is continuing to refine and augment its data collection programs, however, the Jordan River TMDL effort has more data available than many TMDLs. Inasmuch as adaptive implementation may be required to achieve corrections to loading, a preliminary load allocation is still a reasonable goal.	No changes necessary.

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Government	12	66	TM4	"The influence of Utah Lake on the Jordan River, its level and pumping schedule, are significant issues to meeting the water quality standards in the river. Drought and the subsequent low lake levels resulting in pumping to meet irrigation needs are significant detriments to the lake water quality and DO conditions in the river. With TSS being identified as the largest contributor to the low DO in the lower reaches of the river, additional efforts need to be put into the identification of the links to Utah Lake water quality and its improvement, prior to addressing subsequent discharges."	The State is in the process of further assessing Utah Lake. This TMDL helps to provide the justification and impetus for additional WQ improvements. However, which improvements and when implementation is possible are beyond the scope of this TMDL.	No changes necessary.
Individual	13	67	TM4	Information was provided on chemical contamination that results in off-flavors in fish. Specific chemicals mentioned included geosmin and MIB (2-methylisoborneol). These chemicals can result in long lasting (months) off-flavors in fish. Internet resources claim geosmin is detectable in 5 parts per trillion and is a serious problem in water supplies that rely on surface water sources. MIB is a similar substance, also detectable in concentrations of ppb. Both substances are produced by cyanophyta.	Neither geosmin nor MIB are included in the list of numeric criteria, however, Section R317-2-7.2 of Utah's Water Quality regulations with narrative standards that include these considerations: "It shall be unlawful, and a violation of these regulations, for any person to...cause conditions which...produce objectionable tastes in edible aquatic organisms …" Fishing for consumption is an existing use in the Jordan River and cyanophyta occur widely throughout the river in some months. Establishing WQ standards for these and similar chemicals is beyond the scope of this TMDL, but could be considered in future rulemaking.	No changes necessary.
Organization	14	68	TM4	Despite the findings in the technical memo that based on the modeling results, reducing organic matter has a much larger effect on DO than does reducing nutrients, "[p]hosphorous may still be a problem. We request that details on how the finding was determined be provided. Note: The finding is based primarily upon the model. But how this model works to determine this finding is	The model is very complex, but anyone with cursory exposure to MS Excel could understand how it generally works. Time should be provided for demonstrating the model to the "lay persons" (model-wise) on the TAC. Although outside the scope of this TMDL, phosphorus is being considered in the assessment of WQ downstream.	No changes necessary.

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				not clear."		
Organization	14	69	TM4	"We request that the [QUAL2Kw] model be more fully tested. Although that is perhaps what some of the additional studies in 2010 will do. We have the following question regarding the model – does the model mimic the upstream sites where influence of WWTF effluent on DO is not as apparent, e.g. does it account for the important variable or are there others?"	The model takes into account the conditions, inputs, and withdrawals in one-half kilometer sections beginning with Utah Lake all the way to Burton Dam. This includes the inputs from WWTPs, and includes effects on DO in every section.	No changes necessary.
Organization	14	70	TM4	"Because reducing detritus and organic matter in the Jordan River may also provide beneficial results for the wetlands downstream from the Jordan River and surplus canal – we request that the impacts of possible reductions be addressed for these areas. We are concerned that nutrients downstream from the Surplus Canal and the Jordan River are likely still a major threat to the health of the wetlands and Farmington Bay. We request that as the Jordan River TMDL proceeds, a process be developed to demonstrate how this concern will be addressed."	Calculating impacts in wetlands downstream is beyond the scope of this TMDL, but these impacts are being discussed and should be included as the State assesses WQ in those areas.	No changes necessary.
Organization	14	71	TM4	"From our viewpoint it appears that assumptions and information discussed at the previous TAC meeting that identified Utah Lake as the major source of algae that dies quickly and results in the detritus in the Lower Jordan have not been fully assessed or explained. Has the Utah Lake TMDL adequately addressed nutrient reduction?" "A concern that the current analysis is simply setting the stage for a determination that improving DO in the Jordan River has limited potential if the algae/detritus is determined to be from Utah Lake." "Additionally, the DTM discussion for TDS and	Site-specific criteria have not yet been established for any parameter in the Jordan River; it will require an open process to do so. In the case of temperature and TDS, there appear to be few anthropogenic sources that can be reduced. The analysis for organic matter, on the other hand, shows there are several anthropogenic sources of organic matter. The first load allocation scenario for parameters affecting DO in the lower Jordan River will assume that loads from Utah Lake cannot reasonably be reduced. However, the Utah Lake TMDL is still in flux and reductions of organic matter are still a possibility.	Technical memo on endpoints will be revised to reflect need for process to establish site-specific criteria.

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				temperature focused on changing the Water Quality Standards to eliminate impairment found for segments of the Jordan River. DO might be treated similarly if tied to Utah Lake." "Numeric DO Standards for downstream wetlands are already in the process of being eliminated."		
Organization	14	72	TM4	"There was a brief discussion of the use of fish surveys in the segments that were temperature impaired at the last meeting. We are concerned that use of fish surveys that document lack of fish, or fish present but in poor health, should be viewed as a reason for action, not a reason for changing the standards."	One purpose of fish studies is to help establish criteria for those uses it is possible to attain, in part by documenting existing uses, including species and age classes of fish. The 3A and 3 B designations for cold and warm fisheries may be too coarse: the waters can achieve a higher use than warm water fishery, but may be unable to achieve all of the criteria necessary for all cold water fish stages; existing uses may be better preserved and enhanced by some intermediate classification. For example, temperatures may not be cold enough for reproduction of species that do so in mid- to late summer, but they may support adults of those species as well as the reproduction of other cold water species that occur outside of the warmest months.	No changes necessary, however, new findings may emerge from additional aquatic studies.
Organization	14	73	TM4	"Although the Jordan River TMDL focuses only on the center section of the Jordan River Watershed, results so far emphasize that problems found here may require comprehensive changes to the watershed."	They may. Reducing loads from diffuse runoff and stormwater, in particular, may require changes throughout the watershed.	No changes necessary.
Organization	14	74	TM4	"On March 3 there was a very brief discussion about the possible diking that may be required on the Jordan River from 2100 South to 1800 North due to floodplain concerns. Obviously, it will be important to understand what actions may occur that would address this floodplain concern and would also impact water quality in this area."	Such proposals are still in design phases. They should, however, consider pollutant load reductions, reaeration, and other processes related to resolving impairments in the lower Jordan River (and downstream).	No changes necessary.

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Organization	14	75	TM4	"One additional concern which was discussed briefly last week addressed existing data and uneven data sets. It is a situation we all have to deal with and try to assure that the resulting conclusions are reasonably representative. We don't know what changes in conclusions would result if someone tried to balance this data. An extreme example of this situation is Table 4 where data are ranked to determine a cutoff point for the 90th percentile. Ten values are listed above the cutoff, of which eight are for 2004. A total of 15 samples were used from 2004 compared to only 4 for 2008. We request some level of Margin of Safety (MOS) be included in any solution due to the existence of less than robust data sets for most areas, months, seasons or years, and weather events."	A margin of safety is required for all load allocation scenarios. Both explicit and implicit margins are possible. Data that unevenly represents periods of time or space is one explicit reason for a margin of safety.	No changes necessary to previous technical memos. Final TMDL will incorporate a margin of safety.
Organization	14	76	TM4	"Page 3, para 4: Hot springs exist N of Bangerter Highway, E of Jordan River, just east of the new WWTF being built at the base of the hill. They have been signed to warn the public of the hazard."	No documentation was available for this source.	This source will be characterized and included in the updated technical memo(s).
Organization	14	77	TM4	"Page 4, para 3: Restoration of DO conditions that enable healthy populations of sensitive warm water species is extremely desirable."	That is the purpose of the Jordan River TMDL.	No changes necessary.
Organization	14	78	TM4	"Page 6, Permissible Loads: Water quality endpoints for the Jordan River should include permissible loads that allow for some level of recovery in the downstream wetlands. There appears to be plenty of reason to believe that what is causing the DO problems in the Jordan River is also the source of problems in the wetlands and without control of the Jordan River sources, little will be done to stabilize or recover the wetlands."	While downstream WQ is beyond the immediate scope of the Jordan River TMDL, it is a concern and it may be necessary to revisit certain aspects of the Jordan River TMDL as more is learned about downstream and other aspects of the Jordan River system.	No changes necessary.

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Organization	14	79	TM4	"Page 7, Results and throughout the remainder of the document: Comments were made above addressing small sample sizes, and equal distribution of data in creating summary data. Sample sizes should be discussed and presented. Percentages are useful but do not substitute the need for the basis of the averages."	Simple statistics are used in an attempt to understand relationships and patterns. Data on many aspects of Jordan River WQ are limited, usually rendering more rigorous statistical analysis inappropriate. Sample sizes or an allusion to the number of measurements are provided in many cases, however, all of the technical memos can be reviewed again to determine where additional numerical clarification can be useful.	Revise text as necessary.
Organization	14	80	TM4	"Page 7, Results: The first sentence makes a conclusion that requires further discussion and references."	The explanation for that sentence is provided later in that section, but should be moved forward to help the reader to understand the situation.	Revise text as necessary.
Organization	14	81	TM4	"Discuss effect of tributaries on TDS."	Tributaries were not discussed because they are relatively insignificant sources of TDS. In the impaired segments, most tributaries are totally diverted for irrigation and the only significant flows come from stormwater and diffuse runoff. Loads from tributaries are estimated to provide less than 3,000 tons of TDS per year to Segments 5-8. That compares with over 217,000 tons from groundwater, 40,000 tons from SVWRF, and 14,000 tons from irrigation return flow.	
Organization	14	82	TM4	"Correlation of 0.44 seems weak."	Assuming this refers to Figure 8.	A new correlation and confidence level will be calculated and included in revisions.
Organization	14	83	TM4	"Role of shallow ground water seems to need to be better discussed and not assume that future pumping will resolve this source in the central segment of the Jordan River."	Basis for this comment is uncertain. Memo will be reviewed for inferences that suggest future pumping will resolve shallow groundwater loading concerns. Revisions will be made as needed.	Review document for this comment; revise as necessary.
Organization	14	84	TM4	"Page 12, Results: We don't understand why the criterion has to be changed when the source of the problem is known. Table 3 shows that the worst exceedances were for a single year, four of five samples were from 2004. Although the data is	It may not be necessary. This assessment utilized a strict interpretation of the State's rules governing exceedance criteria. Admittedly, except for one measurement in 1995, the only year in which Segment 8 exceeded the WQ standard was 2004	No changes necessary.

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				attributed to 1995-2008, 15 of 26 samples were for 2 years, 2004-5. What made these years so different? Are they representative?"	and no TDS data has been measured at this site in the intervening years. A concerted effort to monitor the Narrows may lead to de-listing of this segment for TDS at the next assessment period.	
Organization	14	85	TM4	"Page 14, Table 4: This Table should not be split between pages, but should be displayed on a single page. Additionally, if multiple columns are used as shown, all samples above the 90th percentile if used in next draft, should be located above all data below the criterion."	Noted. It would be easier to read if formatted as suggested.	Reformat table.
Organization	14	86	TM4	"Page 15, para 1: First two sentences are contradictory and confusing."	Noted. Text should note that two stations can be associated with this Segment, but only one is within it. The other is at the boundary between this segment and the next segment downstream.	Revise text as necessary.
Organization	14	87	TM4	"Page 17: There does not appear to be adequate discussion of the past 5 years to conclude a decline. On Page 18, the conclusion that concentrations do not exceed the standard over the past 5 years is not transparent as there are dramatic changes within 2008 including the highest single concentration measured at this site."	Most of the WQ analysis in these technical memos used a 14 year period from 1995-2008 in order to capture as much of the relevant history as possible. This discussion mentioned the five year horizon because the State only considers the last five years in determining a formal support or non-support status. While 2008 had two of the highest values, it also had one of the lowest and several in between, but below the WQ standard.	Add an explanation regarding rationale for the five year period.
Organization	14	88	TM4	"Page 20, Figure 10: What is the temperature at the outlet of Utah Lake? Why was water temperature change more dramatic for segment 8, than for segments 4, 5, 7?"	No data is available on temperature at the Utah Lake Outlet.	No changes necessary.
Organization	14	89	TM4	"Page 20, para 2: Is SVWRF the only WWTF generating heated water? What makes it different?"	It was singled out because it is the only WWTP within the segments impaired for temperature.	No changes necessary.
Organization	14	90	TM4	"Temperature in Class 3A waters: What is the vision: minimize temperature stress for fish, or,	These questions will be addressed in the assessment of use attainability analysis and site-	No changes necessary to earlier technical memos; but these considerations will be incorporated into

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				change the standard? What is the historical record for the Class 3 A segments? Have there been changes that can be explained? Can changes if they have occurred be due to flow, river depth, sinuosity, etc?"	specific criteria.	site-specific criteria analysis.
Organization	14	91	TM4	"Page 22, Table 11: Impossible to compare segment differences if they occur."	These three impaired segments were treated as one segment for purposes of a compliance point, so the data were combined.	Show which station provided which data point.
Organization	14	92	TM4	DO: "Can in situ or controlled laboratory experiments using site waters, demonstrate the results of the models?"	Probably not. The model incorporates many complex processes, but still must be calibrated to each river. Part of the calibration process involves the selection of specific numeric parameters within accepted ranges, which is performed to match measured results.	No changes necessary.
Organization	14	93	TM4	DO: "Does model work for a site that does not have DO issues but does have detritus?"	The model can predict values for many parameters, including detritus.	No changes necessary.
Organization	14	94	TM4	DO: "What data exist for the Burnham Dam site? The data seems to be either very limited or only shown occasionally."	Data are limited for Burnham Dam. A data set of available data has been assembled and is available for review.	No changes necessary.
Organization	14	95	TM4	DO: "Graphs such as Figure 11 distort actual DO issues due to lack of 24 hour data. Care needs to taken to adequately title Figures and data on them. For example Figure 11 actually shows the average peak DO rather than daily or monthly DO. Violations show only the violations so bad they were found during daylight, not late night."	Figure 11 needs better title and clarification.	Revise text as necessary.
Organization	14	96	TM4	DO: "All graphs would benefit by showing the acute and average standard with horizontal lines."	Figures should be reviewed for adding these standards where appropriate.	Revise charts as necessary.
Organization	14	97	TM4	DO: "Page 27, para 4: Again the appearance of data for Burnham Dam. Also, does the use, of daytime average DO concentrations affect the	The model was calibrated to match the mean, maximum, and minimum DO values observed during synoptic monitoring, which included hourly	No changes necessary.

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				validity of the model?"	measurements collected for several days during diurnal monitoring. Even though there is very little data at Burnham Dam, the model can predict values at that site to ensure that DO would not fall below the WQ criteria during any time of the day.	
Organization	14	98	TM4	DO: "Page 27, para 6: Do we have enough data to determine sources? Relationship to Utah Lake discharges? Load of 'lacustrine' versus non-lacustrine algae? Death curves for lacustrine algae from source? What is needed to make a decision on how to reduce total detritus?"	Data could always be more complete, however, there is more data available for the Jordan River TMDL than for many other TMDLs. Data for algae discharged from Utah Lake is good enough to establish the significance of this source, however, flows, and even species of algae, can vary annually. Lacustrine species typical of those from Utah Lake have a life span of hours to several days, which is shortened by exposure to a riverine environment. Although it would be ideal to have data on detritus (VSS) at multiple sites at monthly or more frequent intervals over multiple years of varying precipitation and irrigation patterns, it is possible to construct reasonable assumptions regarding the contribution of organic matter. This effort will be presented in the next technical memo to support a draft load allocation. Subsequent data collection can then help refine the allocations.	No changes necessary.
Organization	14	99	TM4	DO: "Page 28, Figure 15: Why are not segments 7 and 8 listed as impaired?" "Page 31, first para: See Figure 15, Average DO for 1995-2008 are below 5.5 for five sites shown."	DWQ response necessary?	No changes necessary.
Organization	14	100	TM4	DO: "Page 32, para 4: Is there a compliance point at the Burnham Dam? That would be good."	Cudahy Lane was chosen as the compliance point because of a long historical data set, but the model can be used to predict water quality at Burnham and Burton Dams to ensure violations would not occur anywhere in the lower Jordan River.	No changes necessary.

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Organization	14	101	TM4	DO: "Page 33, scenario 10: Burnham Dam?"	Burton Dam was correct; prescribed SOD was added all the way to Burton Dam because the model can predict DO all the way to the end of the river.	No changes necessary.
Organization	14	102	TM4	DO: "Page 36, Table 15: The flow data seems to indicate the Surplus Canal is included in this Table. Is this true?"	The 2100 South monitoring station is located above the diversion for the Surplus Canal, so calculating loads at this point uses flows before the diversion to the Surplus Canal.	No changes necessary.
Organization	14	103	TM4	"Discussion: Are there ways to reduce detritus?"	Yes. These methods depend on the nature of the detritus. Reducing algae, organic matter in storm and diffuse runoff, and streambank erosion are some examples.	No changes necessary.
WWTP	15	104	TM4	"One issue of concern is the small number of samples that have been collected and analyzed over the last 13 years. Table 2 shows the number of samples collected each moth and the percent TDS exceedances. The segment where the most testing has occurred is segment 4 which only had 24 samples collected between 1995 and 2008, an average of less than two samples per year. All segments shown in the table had at least two months of the year where no samples were collected or reported. It is difficult to trend data and make accurate inferences using such minimal data. South Valley submitted five years of monthly TDS data from 2005 – 2009 for 7800 South and can provide monthly data going back to 2000 for this same location. Using this data would provide a much clearer picture of the seasonal TDS trends in the river over the last five to ten years. Future TMDL monitoring should include monthly testing of TDS sampling for the segments that are shown to be impaired."	More data would help, certainly. The TDS data from SVWRF will be reviewed.	No changes necessary, however, the data will be revisited during the site-specific criteria analysis.

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WWTP	15	105	TM4	"It is appropriate to include segment 6 as being impaired for TDS. The 7800 South sampling location, while just inside segment 5, should be used as the downstream compliance point for segment 6. Several small streams and at least two large storm water drains enter the river between 9000 and 7800 South which should be included in the reporting for segment 6."	If Segment 6 is reclassified as impaired and Segment 4 as not impaired for TDS, the choice of compliance point should be revisited, and 7800 South could be a good candidate. More data on the location of storm water drains between the 9000 South conduit and the SVWRF would be useful; other than Bingham Creek, there are no other tributaries or storm drains documented between the 9000 South conduit and 7800 South in the data for this study.	No changes necessary.
WWTP	15	106	TM4	"South Valley WRF is named as an anthropogenic source of TDS in segment 5. It should be pointed out that the TDS of the South Valley WRF effluent, historically between 900 and 950 mg/L, is below the water quality standard of 1200 mg/L and is almost always less than the river at the point where the plant discharges into the river." "No methods were proposed to lower the TDS in the South Valley WRF effluent and no viable option exists to remove TDS at the facility. One possible method to lower TDS in plant effluent is to fix existing pipelines in the collection system to ensure there is no ground water infiltration. A second method of reducing TDS in plant effluent is to restrict the use of salt based water softeners by homeowners in the collection area. With relatively hard culinary water in most municipalities in the service area, especially on the west side of the valley, restricting the use of salt based water softeners will not be popular with the general public."	Where natural sources cannot be reduced, load reductions may still be required of anthropogenic sources to meet the WQ standards, even if those sources are already below the WQ standard.	No changes necessary.
WWTP	15	107	TM4	"The first large project that will affect segment TDS loading is the new wastewater treatment plant being built at approximately 13500 South. When this plant opens a large portion of the wastewater	Noted. Future flows, concentrations, and loads for South Valley WRF and Jordan Basin WWTP will be adjusted accordingly.	The future flows, concentrations, and loads will be updated per these recommendations. Load allocations will use those future values.

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				currently treated by South Valley WRF will be transferred to the Jordan Basin WWTP. The effluent from the new plant will be similar in TDS to South Valley WRF's current effluent concentration. Effluent from the Jordan Basin plant will continue to be lower than the TDS of the river at that point and serve to dilute the TDS of the river in the upstream end in segment 6. Transferring this flow upstream to the new treatment plant will also affect segment 5 by decreasing the amount of water discharged by South Valley WRF which is currently acting to dilute the TDS concentration at 7400 South." "Another big project that will influence the TDS in the Jordan River in segment 6 is the Jordan Valley Water Conservancy District's shallow ground water collection and recovery system scheduled to start up in the next year or so. It is designed to collect shallow ground water along the bench of the Jordan River, containing relatively high TDS water, and treat it by reverse osmosis for culinary use. The water they are collecting and treating is unmetered groundwater currently entering the Jordan River in segment 6 which contributes to high TDS values in the river. Removing some of this high TDS water from the river system should help to reduce the overall TDS load in segment 6."	The effect of groundwater development on flows to the Jordan were identified in Table 1 of TM4. The impact of groundwater development on TDS loads is discussed in Section 2.2.7 of TM4. The assessment of groundwater development included efforts from JVWCD as well as Salt Lake City Public Utilities.	
WWTP	15	108	TM4	Temp: "The discussion of the practical maximum includes increasing shading to 33% through segments 5, 6, 7, and 8. Planting trees is a two edged sword. While increasing the shading will help lower the temperature the trees will also contribute organic load in the river through leaves and other detritus."	If substantially increasing shading becomes a viable alternative, the organic load should be considered.	No changes necessary.
WWTP	15	109	TM4	Temp: "Reducing the effluent temperature [from SVWRF] to 20 degree C in July and August poses	Further analysis of feasibility will follow the investigation of a site-specific criterion.	No changes necessary.

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				some interesting challenges. Cooling 30 million gallons of effluent a day down 3 or 4 degrees will not be either cheap or easy. The most likely methods of reducing the effluent temperature [are] either through use of heat exchangers utilizing groundwater for cooling, or installation of chillers directly in the effluent flow. Cost estimates should be prepared for both alternatives before further consideration of either as a viable option to reduce temperature in the river."		
WWTP	15	110	TM4	Temp: "As it will be extremely difficult to meet the 20 degrees Celsius requirement for a cold water fishery in segments 5, 6, and 7 of the river, the classification should be reviewed to ensure that it is appropriate. The suggestion to do electro shocking of the river through these sections to see what types of species are currently inhabiting the river would be beneficial when considering changing the classification. Perhaps the classifications could be changed from the two category system of either warm or cold water fishery to include a cool water fishery. The warm water fishery currently has a high temperature of 27 degree C and the cold water has an upper limit of 20 degree C. The third category of cool water fishery could be set in the middle at 23.5 degree C. A reclassification to a cool water fishery as described would, most likely, still require planting trees to cool the river to ensure a MOS in the impaired segments of the river."	The TDS, temperature, and DO TMDLs will be decoupled and further analyses will be developed to determine the existing uses, and use-attainment possibilities, and whether an intermediate use category is appropriate.	The text in technical memo on end points will be revised as necessary.
WWTP	15	111	TM4	"Table 11, according to the legend, includes data for the Narrows, Bluffdale Road, and 7800 south. The table does not include temperatures from the 5400 South station which, in previous sections of this paper, has been used as the compliance point for segment 5. As 7800 South is at the border between segment 5 and 6 it does not represent the	Temperature data from 5400 South would be appropriate to add to the analysis presented in Table 11. Table 10 is derived from the QUAL2Kw model which analyzes each 0.5 km section, so it already includes all of Segments 5, 6, and 7.	Review data available for temperature at 5400 South, revise table as necessary.

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				temperatures though segment 5 and especially the contribution of possibly significant inflow from South Valley WRF. Data from the same time period from 5400 South should be included when calculating the 90th percentile and setting a site specific criterion. On a similar note, the scenarios discussed in table 10 should also include data for the compliance point of segment 5 at 5400 south."		
WWTP	15	112	TM4	"One attendee at the meeting suggested that a possible solution to the temperature problem would be to widen and re-channel the river to include meanders. A better solution to control temperature would be to deepen the channel to make the river narrower. Deepening the channel should include leaving deep pockets where cooler water could collect and allow aquatic life a location to inhabit when water temperatures increased in July and August. Also making the river narrower would help increase the percent coverage from trees shading along the edges of the river."	Reconstructing the channel of the Jordan River would probably not be a preferred alternative, as it would result in complex interactions involving reaeration, DO, etc.	No changes necessary.
WWTP	15	112	TM4	"The paper points to the organic component of suspended solids as being a major contributor to water column BOD and SOD. However, historically no testing has been done to measure the organic or volatile fraction of the Total Suspended Solids (TSS). Volatile Suspended Solids (VSS) testing should be conducted on all TSS samples collected in the future to provide information on the amount of organic material present in the water column. If organic load is a significant source of oxygen demand then testing of all water inflows, including all tributaries, must be done to estimate loading from each source which can then be used to develop methods for reducing the loads entering the river."	If an endpoint of VSS is adopted as a pollutant endpoint to control DO, then future monitoring would be very important.	No changes necessary.

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WWTP	15	113	TM4	Looking back through the data in Work Element 2 soluble BOD (ScBOD) was not one of the parameters measured in the river. This means the supposition that unusually high concentrations of soluble BOD are present in the river is being driven by the model. As this is a significant change from the expected source of oxygen demand it would be prudent to include soluble BOD analysis in the testing performed in the future to verify the actual values for this parameter. The paper suggests that soluble BOD is expected to be coming from wastewater treatment plants. ScBOD is easily treatable by the wastewater treatment plants and it is doubtful that much is being contributed from these sources. Again testing is imperative to confirming the major sources of the ScBOD load."	SCBOD was measured during the synoptic events because it is a direct input in the QUAL2Kw model. Reducing SCBOD, however, was not found to have a significant impact on DO, and it is unlikely that an endpoint will be selected for SCBOD by itself.	No changes necessary.
WWTP	15	114	TM4	"A majority of the flow leaves the Jordan River at the Burnham Dam going into the Surplus Canal. The velocity of water in these lower sections of the river is very slow which exacerbates the dissolved oxygen problem through increased temperature and lack of mixing. A change in the management of the river allowing a larger volume of water to stay in the river could increase the velocity in the river through these sections and moderate the overall dissolved oxygen problem."	It is assumed the commenter means the "State Canal Diversion" rather than "Burnham Dam." Changes to the pattern of flows in the lower Jordan River are a possible management strategy, however, management of the Jordan River involves many complex considerations. The TMDL process will first attempt to resolve the impairments without altering flow regimes.	No changes necessary.
WWTP	15	115	TM4	"It is interesting that the model does not directly attribute the oxygen depletion to total phosphorus and other nutrients at the current state of the river. It is understood that changes to the river ecosystem could eventually allow phosphorus and nitrogen to develop into significant sources of impairment. It is prudent to encourage the wastewater treatment plants to do whatever is within their power to minimize nutrient discharge and hopefully reduce	The model was limited to the Jordan River itself; it is possible that nutrients, while apparently not a major contributor to low DO in the Jordan River, could play a major role in low DO in the wetlands and Farmington Bay downstream of Burton Dam. Significant VSS loads were found in WWTP effluent. Reducing VSS throughout the river will also reduce TP.	No changes necessary.

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				their loading in the future. Getting a handle on the amount of Volatile Suspended Solids (VSS) can be significant in controlling the total phosphorus contributed from non-point sources. The measurement of Total Phosphorus includes the fractions, ortho phosphorus (phosphorus outside the cell wall) and digested phosphorus (the amount of phosphorus contained within the solids). Ortho phosphorus is easy for plants and bacteria to utilize for food and does not exist long in the environment so a majority of phosphorus being measured is contained within the solids. It is expected that while phosphorus does chemically bind with sediments, the majority of the phosphorus will be contained in the organic fraction of the suspended solids. There should be a significant correlation between the amount of VSS and Total Phosphorus present in a sample. Identifying the sources of VSS and limiting the loads from these sources will indirectly reduce the Total Phosphorus load in the river."		
Government	16	116	TM5	"Salt Lake City agrees with the comments submitted by the POTW Jordan River Farmington Bay Water Quality Council, addressing the investigation of the Jordan River based on a watershed approach. Looking at the watershed as a whole from Utah Lake to the Great Salt Lake (GSL) provides additional opportunity to understand the dynamics of the river and the pollutant impacts on the overall watershed. Significantly increasing the VSS data on the river system is an absolute requirement to further substantiate attempts at allocations."	This TMDL is necessarily limited to the Jordan River both in terms of statutory requirements related to its 303(d) listing as well as the need to focus on a manageable scope. It is not, however, blind to the broader ramifications on the Jordan River from upstream sources and the impacts from the Jordan River on downstream conditions. This broader scope is incorporated both in the recognized uncertainty of pollutant sources and expected effectiveness of recommended management solutions. This uncertainty, in turn, pushes the TMDL toward an adaptive implementation approach. That said, there is a compelling need to begin addressing WQ in the Jordan River immediately, although in ways that do not unreasonably preclude future options and	No changes necessary.

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					do not incur unreasonable costs.	
Government	16	117	TM5	"Stormwater is notorious for variability in pollutant loading during storms. The length of time between storm events, the duration of the storm event, and the weather patterns between the events all contribute significant variability to the loading rates from the storm. Volume of runoff from storms is also unpredictable. Due to climate change, storm flows may well increase in the future, but to assume the loading would increase as well is not a valid assumption. Frequent storms leave streets and hard surfaces relatively clean and they therefore contribute fewer pollutants with each successive event. It is highly unlikely that storm flows can be significantly controlled. Load allocations need to consider the impractical nature of controlling storm flows and compensate for their loading."	Stormwater is much more unpredictable than some other sources of loading. The pattern of future flows and loads is unknown. Higher flows may mean lower concentrations, but it is still reasonable to assume total loads may increase as the amount of impermeable surface increases in the system. The net effect on WQ concentrations into the lower Jordan River may, however, decrease. In the midst of so much uncertainty it is reasonable to forecast a "no action" increase in loading and adopt an aggressive program of monitoring and frequent revisiting of loading analyses with which to guide implementation approaches. This conservative approach is acknowledged in the margin of safety required for every TMDL.	No changes necessary.
Government	16	118	TM5	"While attempts are being made to reduce the pollutant loads in the natural streams, it is impractical to allocate significant reduction goals, up to 80% reduction, for the contribution for these natural sources. The most probable method of improving the Jordan River seems to be to attempt structural changes to the river itself to increase DO."	The practicability of load reductions is specifically excluded by federal statute from the determination of TMDL endpoints. However it has been the State's experience that establishment of an implementation strategy that is both realistic and achievable greatly increases the potential for eventually achieving water quality goals. Structural changes within the Jordan River are anticipated to be part of this strategy but are outside the purview of determining TMDL endpoints. Moreover, although structural changes are one strategy being considered for future implementation, they are not expected to be sufficient to resolve the DO impairments, requiring some reductions at the sources.	No changes necessary.
WWTP	17	119	TM5	"Biochemical Oxygen Demand (BOD) to Total Suspended Solids (TSS) or Volatile Suspended	The load allocation analysis recognizes the limited availability of direct measurements of VSS, paired	No changes necessary.

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				Solids (VSS) Ratio Calculated not Appropriate Under all Conditions:" "Biochemical Oxygen Demand (BOD) is a test used to measure the amount of material present in the sample that can be utilized during the test period as food by the microorganisms present. The most common test procedure, the BOD5 test…only measures the fairly easily biodegradable organic compounds. For samples from similar sources, large pools of data can be used to produce accurate ratios, such as BOD to TSS or BOD to VSS. However, sources whose organic components have slower rates of biodegradability are expected to have different ratios…" "Sources such as the POTWs have fairly consistent discharges and large enough pools of data to generate accurate ratios for BOD to TSS and BOD to VSS. However, the majority of the TSS and VSS in the river do not come from POTWs and are expected to be composed of significantly different types of organic compounds." "Conditions in the river are constantly changing through the year and utilizing values from a limited pool of data suggest a static model or constant condition for the river which is not the case. Spring runoff, through May and June, have higher flows, higher than usual water velocity, and carry a much higher load of sediment. (No actual VSS data from spring runoff) The data presented shows significant differences between winter and spring loading for other parameters which suggest that a different BOD:TSS and BOD:VSS ratio would be developed if adequate data was available. The only way to have accurate, truly defendable, ratios is to do year round testing for a	comparisons of VSS and BOD, and the characterization of BOD as fast or slow. These limitations exist spatially, seasonally, and across different annual precipitation regimes. Efforts are underway to augment this dataset to provide more certainty in the nature and timing of loads. In the meantime, assumptions are possible to estimate loads and it is possible to adopt an adaptive implementation approach to reducing loads, thus enabling progress toward WQ goals while minimizing irreversible and unreasonable costs. See more extended explanation of the use of BOD to estimate VSS in the response to Comment #156.	

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				long enough period of time to be able to see and understand the seasonal trends and how they affect VSS deposition in the lower reaches of the river."		
WWTP	17	120	TM5	"Lack of VSS Data: In section 2.1.1 the second paragraph discuses the logical thought progression that takes a very small amount of VSS data and using an extremely general assumption ("BOD, an alternative measure of OM") and also a couple of correlations to transform other data into estimated VSS values. These values are then incorporated into the model and even used to estimate data that does not exist. I understand there is a need to move on with the study and that VSS came as a surprise contributor, but before this data can be used to extrapolate complex solutions the assumptions and correlations should be verified before proceeding. The strength of the model in predicting an accurate solution is in the values that are input into the program. The old saying "garbage in, garbage out" comes to mind. Then late in the paper, page 13 paragraph 4, and page 15 paragraph 1, discuss the need for correction factors. Where is the justification for using these values? Issues like these raise the question, is the model working for us or are we working the model?" "The POTWs and the Jordan River Farmington Bay Water Quality Council (JRFBWQC) have been including VSS testing on the samples they have been collecting since the first of last summer. This data could be used to supplement the VSS data from DWQ and check the acceptability of the hypotheses used by the contractors when converting BOD and TSS measurements into estimated VSS values." "South Valley WRF runs effluent TSS and VSS six days a week and we have data going back at	The QUAL2Kw model pointed directly to organic matter, measurable as VSS, as the prime contributor to DO-demanding processes in the lower Jordan River, and resulted in a maximum concentration that might resolve the DO impairment. The next step of determining the sources of organic matter or VSS was hampered by the lack of extensive long-term data on this pollutant. The VSS spreadsheet model was created to quantify the sources of VSS in order to determine their relative contributions of this pollutant to the lower Jordan River. The limitations of applying this VSS model have been acknowledged, as has the need for additional data to supplant the assumptions in the model. The "correction factor" was necessary to estimate a future "no action" VSS environment with which to compare the concentration limits (endpoint) determined in QUAL2Kw in order to determine the reductions that may be needed. Future data collection is underway and will help to lessen the uncertainty associated with this VSS model. An adaptive and phased implementation approach could achieve some WQ progress while avoiding unreasonable costs and irreversible remedies. The VSS model will be adjusted before the final TMDL and, based on the data presented, it may be reasonable to use a lower VSS:TSS ratio of 0.85 for SVWRF.	Consider using a ratio of 0.85 for VSS:TSS from SVWRF.

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				least ten years. Looking at the data since the first of the year, the average VSS component of the TSS measurement is 84.5%. The contractor has previously used a constant of 0.9 in the calculations based on a few diurnal events. A more accurate and defensible value would be 0.85. The other POTWs should also be contacted to ascertain if they also can supply historical data for TSS and VSS from their facilities."		
WWTP	17	121	TM5	"COD a Better Predictor of Total Decomposition than BOD When Representing SOD Measurements: The paper presents the scenario of VSS present in the river settling out in the slower sections of the river below 2100 South and becoming incorporated into the sediment. Aerobic biological activity continues to break down the volatile components trapped in the sediments consuming oxygen from the water. In theory decomposition will continue, over an extended period of time, until all of the available food is consumed. This extended process no longer mimics the design of the BOD test which limits the test duration to 5 days. A better measure of organic loads being trapped in the sediment for long term degradation is Chemical Oxygen Demand which measures the total amount of volatiles present in the sample not being limited to 'easily' biodegradable fraction." "Following this same line of reasoning section 2.1.1, VSS Pollutant source Loads, the second paragraph includes the statement '… BOD (an alternative measure of OM (organic matter)…'. BOD can only be assumed to be a measured of 'easily degradable' organic matter and not representative of organic matter as a whole. Detritus makes up the majority of VSS found in the river, coming from grass, leaves, fibers, stick,	BOD was used only as a predictor of VSS where TSS or VSS:TSS ratios were unknown. The conclusions from the QUAL2Kw analysis were along many of the same lines, to wit: decomposition in the water column is significant, but the long term decomposition of settled organic matter is probably a much larger DO demand. This can be measured and has been measured directly as SOD and additional measurements are ongoing to better characterize this effect. BOD is presently being characterized to determine its slow and fast components. Based on that assessment, it may make more sense to monitor COD. See more extended explanation of the use of BOD to estimate VSS in the response to Comment #156.	No changes necessary.

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				etc. None of these types of organic components will be accurately measured in a BOD5 test. Again in future testing COD is perhaps a much better indicator of true volume of oxygen needed to complete decomposition of complex organic matter and should be added to the list of tests."		
WWTP	17	122	TM5	"Reducing Load Allocations for Tributaries: One of the major flaws in the proportional load reduction scenario discussed in this paper is the ability to remove the volatile suspended solids from the tributaries which are currently the major source of VSS excluding Utah Lake. There are three flaws in the assumption that VSS can be removed from the tributaries. First, there is currently no realistic technology to remove the VSS from the rivers. Second, there are no funding mechanisms in place to cover the costs if there were a viable form of treatment. And third, there is no agency with any authority to pressure cities and towns to provide any type of mitigation. With these in mind, it is foolish to approve this proposal and expect any measureable improvement in water quality and/or reduction in VSS loading in the river to occur."	The proportional load scenario is only one of several possibilities, and was only used as a starting point. The "flaws" mentioned are some of the considerations that will be incorporated into a "most practicable" scenario. In particular, both the technical capability and the regulatory authority to force load reductions from storm water, tributaries, and other sources are serious constraints that will affect the final allocations.	No changes necessary.
WWTP	17	123	TM5	"Load from Utah Lake Regarded as Untreatable: Another fatal flaw in this proportion load reduction scenario is ignoring Utah Lake. It is difficult to throw support behind a proposed solution that is willing to ignore 50% of the problem. Using 50% of the sources to fix 100% of the problem suggests that each of the remaining sources will have to be cleaned up twice as much to make up for the ignoring Utah Lake. Expecting sources to remove more than their share or more than they are contributing is a difficult position to defend or to justify. Again, a solution that ignores half of the problem does not appear to have much	Because of settlement, dissolution, and diversions between Utah Lake and the lower Jordan River contributions from Utah Lake to the impaired reaches below 2100 South are far less than 50%. Nevertheless, investigations are under way to determine the extent to which it is possible to reduce loads from Utah Lake. The initial proportional allocation scenario was only a starting point and will be revised before TMDL submission and also perhaps during a phased implementation.	No changes necessary.

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				chance of success suggesting that it might not be the right solution."		
WWTP	17	124	TM5	"Additional 70% Removal at POTWs: The paper shows that the POTWs currently are contributing approximately 19% of the VSS found in the river. The POTWs are easy targets to force change because there is already a regulatory oversight in place through their UPDES discharge permit. It is possible to remove an additional 70% of the VSS from their effluent but the cost would be in the tens of millions of dollars. Keep in mind that the POTWs are already removing at least 96% of the solids entering their plants. Tens of millions of dollars would be spent fixing 19% of the problem leaving 80%, the vast majority, to go untreated. I am not sure this is the wisest use of public funds and does not give much bang-for-the-buck in treating the overall problem."	There are a variety of considerations with proposals to reduce each of the sources. Cost is one, technical capability and practicality of reducing sources without regulatory authority to enforce reductions is another. These limitations will be further explored for the "most practicable" scenario in the next phase.	No changes necessary.
WWTP	17	125	TM5	"Alternative Solution- Aerating the Segments of the Lower Jordan River: As current technology does not provide a reasonable method to remove VSS from either Utah Lake or the tributaries it seems another solution should be developed to mitigate the low dissolved oxygen (DO)levels in the lower Jordan River that develop in late summer. A solution that could provide immediate results and be designed to maintain the DO above threshold limits is installation of aeration systems through the three segments experiencing low DO issues. These systems would be significantly more economical than upgrading POTWs and have the capability to negate the effects of all the sources including Utah Lake and the tributaries which are otherwise untreatable."	It is unclear what the costs of aerating the entire lower Jordan River would be and whether they would provide a long term solution. There are several advantages, including applying the solution only during those times of year or day when DO is lowest. However, without reducing the sources of VSS the problem may only compound in the future. Moreover, there are probably other aspects of VSS that impair aspects of aquatic habitat that are less easy to measure. Further, aeration involves energy costs which are likely to escalate in the future, and may contribute to other environmental problems, such as air quality. Strategies other than reducing the pollutant loading at the source are therefore much less attractive as a holistic solution for the long term.	No changes necessary.
Organization	18	126	TM5	"One thing we probably should have commented	Abbreviations should be easily recognized.	Document will be amended accordingly.

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				on in the [formal] letter is that we could not easily find what VSS stands for within the document. We would suggest putting this in the abbreviations section on Page A-1 and reviewing the document to make sure that VSS is spelled out first before used in the text."		
Organization	18	127	TM5	"If reducing VSS works, what would be the outcomes for the lower Jordan River besides [higher] Dissolved Oxygen? Would the Jordan River smell better? Would the water look better? Would the lower Jordan River water be more suitable for fishing, canoeing, rafting, and swimming as well as other recreational activities. Would it be a better place to live next to?"	Whereas VSS contributes to TSS and turbidity, reducing VSS will improve all of these aspects.	No changes necessary.
Organization	18	128	TM5	"The document talks about reducing VSS below 2100 South on the Jordan River by allocating reductions upstream of 2100 South. These upstream reductions would also result in a major reduction of VSS in the Surplus Canal. We think the impacts of this decrease in VSS in the Surplus Canal should be understood and documented, especially since most of the water in the Jordan River at 2100 South goes down the Surplus Canal."	The Surplus Canal is outside the formal scope of the Jordan River TMDL; however, WQ in the canal would improve markedly with reductions in VSS concentrations. Monitoring that improvement could be an important component of future efforts to enhance the Surplus Canal water body.	No changes necessary.
Organization	18	129	TM5	"If VSS is reduced we would like documentation as to the impacts this would have on the wetlands in Farmington Bay at the end of the Jordan River and Surplus Canal."	It could include higher DO entering the wetlands and lower loads of organic matter that could contribute to SOD within the wetlands. Documentation would come from WQ measurements within those systems. Prescribing these monitoring efforts is outside the scope of this TMDL, but DWQ is sympathetic to the need to achieve acceptable water quality in both the wetlands and Farmington Bay itself.	No changes necessary.
Organization	18	130	TM5	"Previous comments have asked that Nitrogen and	Nutrient loading is certainly a consideration for	No changes necessary.

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				Phosphorous be addressed for the wetlands beyond the scope of the Jordan River TMDL. This concern remains, particularly since the main action will likely be an effort to reduce VSS, and this likely does not address the nutrient loading concerns for the wetlands." "Even though we understand the rationale for taking on a problem of a 'smaller scale' we continue to request a full discussion of how nutrient loading in the Jordan River will impact wetlands downstream. We believe this is a prudent step in order to fully understand the water quality concerns that need to be addressed on the Jordan River."	these downstream systems, but will be addressed within other WQ programs.	
Organization	18	131	TM5	"There is a recent study (details below) that we recommend be sent out to the Jordan River TMDL Technical Advisory Committee. This study talks about alternative futures for the wetlands in Farmington Bay, including wetlands downstream from the Surplus Canal. It also addresses possible decreases in nutrient loads. While this study is a research project and not regulatory as the Jordan River TMDL effort is (as discussed on page 54 of the report), it provides useful background information, including how wetland concerns regarding nutrients might be addressed. This includes wetlands downstream on the Jordan River and the Surplus Canal." "Information presented and the views expressed herein are strictly the opinions of the authors and in no manner represent or reflect current or planned policy by the USEPA. Sumner, R.1, J. Schubauer-Berigan 2, T. Mulcahy 3, J. Minter4, B. Dyson 2, C. Godfrey3 and J.Blue 3 2010. Alternative Futures Analysis of Farmington Bay Wetlands in The Great Salt Lake Ecosystem. U.S. Environmental Protection Agency, Cincinnati,	We have acquired a PDF copy of the study and can send it to the TAC upon request.	No changes necessary.

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				OH, EPA/ 600/ R-10/ 032."		
Government	19	132	TM5	"I would highly recommend that the 'Future Efforts' be followed. The recommended reductions are very large, and the uncertainties of the model effort need to be understood before such large reductions are applied to stakeholders."	DWQ has begun additional data collection (main aspect of the recommended future actions alluded to) focused on better spatial and temporal resolution of VSS. This should help substantially in reducing uncertainties regarding sources and loads.	No changes necessary.
Government	19	133	TM5	"p. 4, 3rd paragraph: The reference to Santec 2009, is for 2010 in the reference list."	Edit document.	Edit document
Government	19	134	TM5	"p. 8, 1st paragraph: Following the EPA recommendation described here might not be complete because it is not clear that all the anthropogenic sources have been identified. I would agree the major sources are included in the study, however."	Some sources certainly have not been completely characterized; more data is being collected to narrow that gap. The error between measured and modeled values, however, was not ascribed to natural sources but rather apportioned to all sources.	No changes necessary.
Government	19	135	TM5	"p. 8, 2nd paragraph: Note that 'additional data collection will reduce the level of uncertainty, and possibly the MOS.' This is what I referred to above."	Refers to comment #132 above. Noted.	No changes necessary.
Government	19	136	TM5	"p.9, last paragraph: I appreciate the candid statement about the limited understanding about load contributions, and think it is a matter of concern before implementation."	No response necessary.	No changes necessary.
Government	19	137	TM5	"p. 11, 3rd from last paragraph: Proxy ratios and proxy streams were used for some loads. This raises concern as in the last comment."	More data is being collected to narrow this gap.	No changes necessary.
Government	19	138	TM5	"p. 13 in general: All models require assumptions, but this is a long list, which reduces the certainty of results."	More data is being collected to narrow this gap.	No changes necessary.
Government	19	139	TM5	"p. 15, paragraph 1: Calculated load and measured	These other two possibilities will be noted.	Note in revised document additional explanations

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				load at 2100 did not agree. The correction factor could be an indication that the flow balance is not well understood. It also could suggest missing loads that are not accounted for by the model."		for disagreement between predicted and measured loads.
Government	19	140	TM5	"p. 16, paragraph 2: It strikes me that when loads are to be adjusted, the proportional allocation followed here will run into varying degrees of technical feasibility. It might be necessary to let some loads be reduced more because others cannot be changed, where they were all given the same proportional goal by this approach."	This is the basis of the "most practicable" scenario to follow.	No changes necessary.
Government	19	141	TM5	"Table 5: I am struck by the 4th column, "Estimated Observed VSS Load." I have to think the Observed should not be there or else something else was meant by this."	Column title should be reworded "Estimated Future Unadjusted VSS Load".	Column title should be reworded "Estimated Future Unadjusted VSS Load".
Government	20	142	TM5	"We concur with statements in the document indicating that while nutrient reductions are not the focus of attainment of DO standards in the Jordan River Segments 1, 2, and 3, nutrient loading into the Jordan is of significance for water quality in downstream receiving waterbodies including downstream wetlands and Farmington Bay. We support UDWQ in its efforts to evaluate the impact of nutrient loading to downstream waters of the Jordan. We would encourage UDWQ to undertake a timely and comprehensive analysis of nutrient loading throughout the Jordan River watershed."	Comment noted.	No changes necessary.
Government	20	143	TM5	"The WQU notes that the document addresses critical conditions and identifies a target concentration of organic matter necessary to achieve a conservative dissolved oxygen endpoint that is consistent with approved dissolved oxygen standards. The document identifies the uncertainty in the analysis including the limited dataset for	Noted.	No changes necessary.

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				VSS, lack of worst-case DO data, influence of sediment oxygen demand on the Jordan, and modeling uncertainties. For these reasons, a conservative dissolved oxygen endpoint was chosen for the TMDL development to ensure attainment of the daily minimum, 7-day average, and 30-day average dissolved oxygen standards. This is an appropriate approach for setting a margin of safety, which is a required element for a TMDL." "In addition, the concentration of organic matter found to result in attainment of the dissolved oxygen endpoint under critical conditions was applied year-round as data were not available to determine if seasonal relaxation of this target concentration would result in attainment of dissolved oxygen water quality standards. Given the uncertainty, this is an approvable approach for load capacity establishment as a TMDL must be calculated to at least achieve water quality standards and may not be less conservative. Therefore, we believe that the approach used in the Technical Memo is reasonable."		
Government	20	144	TM5	"UDWQ is asked to clarify whether or not the QUAL2Kw model was verified against a second data set not used in its calibration."	The QUAL2Kw model was calibrated to three synoptic events and verified against a fourth that was not used for the calibration.	No changes necessary.
Government	20	145	TM5	"UDWQ is asked whether or not there has been consideration given regarding how upstream nutrient loads entering the watershed at or above Utah Lake and within the tributaries to the Jordan contribute to the organic material load from these waterbodies into the Jordan. The WQU believes this is an important analysis for understanding the ultimate source and potential control measures for organic material in the system."	The determination of VSS as the pollutant of primary importance was made by adjusting loads of various nutrients and organic matter at the upstream end of the lower Jordan River (2100 South). The model has not been used to determine to what degree basic nutrients are contributing to the growth of algae that adds, either as living or dead organic material, to the VSS entering the lower Jordan River. However, the short transit time involved in this river suggests that it would	No changes necessary.

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					not be a major contributor. Clearly, however, the VSS must come from somewhere, and part of it is certainly algae that develop within the system. More analysis is needed to refine this composition and it makes sense to do so after additional data is available on the spatial and temporal distribution of VSS.	
Government	20	146	TM5	"UDWQ explains several allocation schemas that could be considered for TMDLs in general. The allocations approach chosen in this case is based on the current/future percent contributions from each source with required reductions applied to all the sources while maintaining essentially the same relative percent contributions for the sources (excluding application of reductions for Utah Lake). Though the reasoning behind the allocation approach is clear, details regarding the feasibility of achieving organic mater loading reductions for the sources that are identified are not provided. For example in Table 6, tributaries have a VSS allocation requiring a 74% reduction from current conditions. However, there is no discussion as to the contributors of organic matter to the tributaries; and hence, no way to evaluate whether or not this percent reduction of organic matter could be reasonably achieved. We recognize that UDWQ plans to prepare additional technical memos for this project and request that additional details regarding the tributary sources be provided in those documents to demonstrate the feasibility of source control in these waters."	The proportional load scenario was developed first because it is the simplest and helps to frame the discussion about the nature of VSS as a pollutant and its fate within the Jordan River. Additional work will be underway in the next phase to determine costs and factors affecting implementation success. These will be combined into a "most practicable" scenario.	No changes necessary.
Government	20	146	TM5	"…Utah Lake is identified as a source for which there is no assigned load reduction. From the document and presentation, it is not clear why load reductions from Utah Lake are not practical or not required. As long as the load allocation scenario is feasible for achieving the TMDL without	The beginning assumption of not being able to reduce the loading from Utah Lake was in part due to that body of water being governed by a separate TMDL process. Moreover, Utah Lake accounts for a relatively low proportion of the organic matter that is transported from this source into the Jordan	No changes necessary.

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				reductions from Utah Lake, UDWQ has the discretion to not require reductions of this source. However, it is not clear why UDWQ believes that reductions from Utah Lake are not possible while significant reductions from the tributaries are possible. UDWQ is asked to provide more clarification on why Utah Lake is excluded from required load reductions."	River below 2100 South during the critical late summer season (less than 9%). In the future, it may well be possible to also include load reductions for Utah Lake. In the meantime, a phased implementation of a Jordan River TMDL will provide some latitude in load allocations as more is learned about patterns and sources of loading, as well as effectiveness of reduction strategies.	
Government	20	147	TM5	"Since load reductions are being applied to waterbodies such as the tributaries entering the Jordan, it will be important to determine the ratio of point source and nonpoint source contributions of organic matter in those waterbodies that are contributing to the Jordan. One need only move upstream distinguishing between point and nonpoint source loaders to the extent where enough sources are identified to achieve the required load reductions. All loads further upstream that do not require control may be considered as part of the nonpoint source incoming load to that waterbody."	Improvements in future monitoring should improve identification of individual sources.	No changes necessary.
Government	20	148	TM5	"We recognize that there are limited data regarding VSS and sources of organic matter largely because it was not expected to be the pollutant of concern in this analysis. Hence, the analysis gaps noted above related to source control are understandable at this point in the TMDL development. Ultimately, these gaps will need to be addressed so that the Jordan TMDL, if fully implemented, will result in attainment of water quality standards for dissolved oxygen. The level of uncertainty along with the need to move forward with the TMDL may warrant consideration of applying a phased-approach for the TMDL development."	A phased approach to implementation and load reduction allocations is being considered.	No changes necessary.

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WWTP	21	149	TM5	"The most recent Phase II technical memo highlights the issue that any resolution of Jordan River water quality is interconnected with the both Utah Lake issues and the wetlands, Farmington Bay and open water of Great Salt Lake. Two points that have been extracted from the Phase II report illustrate this conclusion:" "By far the largest contribution of volatile solids to the Jordan River is Utah Lake (Table 2 of the report). The effect of this load on the VSS load below 2100 South is dependent on the actual settling rate of organic matter from Utah Lake which is largely unknown, although Rushforth's work tends to indicate that it reaches this far downstream. Table 2 does not propose a change in loading from Utah Lake, and the report further states "A key assumption is that no reasonable changes would take place in flow or concentration at Utah Lake." This statement seems to assume the Utah Lake TMDL and the Jordan River are separate and not individual parts of a single watershed." "As can be seen from these two points reiterated above, the fate and future of Utah Lake, the Jordan River and Great Salt Lake are highly interconnected. We know of no one who disputes this. To assume that a Jordan River TMDL should not consider discharges from Utah Lake is a great mistake. Similarly, it would also be a major mistake to not consider potential changes in nutrient loads when evaluating water quality issues in the impounded wetlands or estuaries of Great Salt Lake. Far better would be to interconnect all of these issues as we proceed with determination of ultimate solutions." "This leads us to the conclusion that it is impossible to complete an individual TMDL for	The Rushforths' work indicates that some lacustrine species from Utah Lake apparently do make it to the lower Jordan River. However, "Figure 16. Total algal biomass by site, Jordan River July – October 2009" in their 2009 report on periphyton shows a reduction in biomass between Utah Lake and 9000 South of 75 percent in July, and perhaps more than 95 percent in August – October. As the transit time of approximately one day would be too short for this much biomass to be decomposed, this provides strong evidence for rates of loss to settlement or dissolution actually greater than assumed in the QUAL2Kw. The working assumption of not being able to reduce loads from Utah Lake is based more on the need to begin resolving WQ impairments in the Jordan River in the face of uncertainty in being able to reduce Utah Lake loads than an assertion that the Jordan River is isolated. It is, certainly, necessary to consider the entire watershed, but the complexity of doing so will require much time, and efforts to resolve WQ in the Jordan River should not wait for that complete understanding.	No changes necessary.

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				the three segments of this watershed. Utah Lake, Jordan River and Great Salt Lake are parts of one watershed and the watershed should be looked at in its entirety." "Without this holistic approach we fail to address the net effect one segment has on the next. Trying to solve each segment individually will only result in overall failure. For this reason we strongly recommend that the State step back and reevaluate the approach that is being taken to assure water quality needs are met. We suggest a full watershed TMDL be prepared to guide overall water quality efforts."		
WWTP	21	150	TM5	"Improvements in Jordan River Dissolved Oxygen: The Phase II Technical Memo recommends reduction in VSS (organic matter) from all sources which discharge to the River. While this may be an appropriate approach and possible end point, we are skeptical that sufficient sampling of VSS has been done to fully justify this position. In addition, removal of VSS/organic matter from non-point sources may be very difficult and costly. We offer as an alternative adding an aeration feature in the segment of the Jordan River where the DO sag may be occurring. Such feature would require only periodic operation which could be automatically controlled by River DO measurements. The addition of the DO/aeration feature could be implemented quickly and at a relatively low construction cost and the costs could be allocated to the entities which benefit from not having to remove VSS. This would immediately remove the impairment and allow time for the proposed entire watershed TMDL to proceed. Since the River flows are highly managed, this approach would also be able to respond to management practices in removing	The need to reduce organic matter loading and the endpoint are validated by the QUAL2Kw in its current calibration, which was accepted by the technical review committee. Exact load reductions are uncertain because of the limited availability of data on organic matter loading but, rather than delay, this suggests a phased approach where some improvements can be sought even as more information is gathered. Artificial aeration is not an acceptable solution at this point because it has not yet been demonstrated that adequate VSS reductions cannot be achieved.	No changes necessary.

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				the DO sag." "Conclusion: The information in this memo outlines the items of concern we have relative to the Jordan River TMDL thus far. With the installation of a stop-gap aeration station on the Jordan River, we are positioned to move forward with a basin wide TMDL. We strongly recommend consideration of the basin wide TMDL as the preferred approach for further action. The basin wide TMDL approach is a watershed approach supported by EPA, environmental groups will support the basin wide TMDL since it requires the inclusion of Great Salt Lake issues immediately in the TMDL process, and we believe it is the only approach which can systematically resolve any water quality issues that may be present in the watershed on a priority basis."		
WWTP	22	151	TM5	"Starting with P. 3. Section 1.2.3 Dissolved Oxygen: The report immediately presents an argument for the transition from the prescribed SOD that was required to calibrate the model to OM (organic matter) and then states 'The most available form of data that could be correlated with OM is TSS. Initially, TSS was considered the most relevant loading affecting DO levels at 2100 South based on an assumed OM content.' (Cirrus 2010)" "This argument and its underlying assumptions are unsupported by the data. The Jordan River/Farmington Bay Water Quality Council (The Council) has been collecting nutrient, TSS, TVSS, BOD and CBOD samples at approximately 30 sites on at least a monthly frequency since May of 2009 (Data is also attached). For example, a comparison of TSS:BOD at 2100 S is presented in Fig. 1. There is virtually no correlation between TSS and BOD. Therefore, no correlation should be assumed by the DWQ or its contractor. Indeed,	No argument is being made to transition from SOD. SOD is still regarded as the single largest demand on DO in the lower Jordan River. What changed as a result of the recent analysis is the cause of that SOD. Rather than nutrients, which might result in algal growth and decay within the lower Jordan River, it now appears that it is organic matter, or VSS, entering the lower Jordan River and settling to the bottom that is causing the high SOD. BOD and cBOD are insufficient measurements of that organic matter because they are typically limited to the 5-day analysis period, whereas much of the organic matter entering the lower Jordan River may take longer to decompose, and it certainly has that time available as it sits on the river bottom. The Council's data are very important and useful but they, too, are limited to only a few months and all within one year. The lack of correlation between those few paired BOD and TSS	No changes necessary.

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				these types of assumptions and hypothetical data correlations should not be attempted for TMDL preparation unless a sound relationship can be demonstrated. Reasons for this lack of correlation and suggestions for data collection are listed throughout the remaining comments below. In short, the assumptions in this document are simply too premature and inaccurate."	measurements does not undermine the hypothesis of VSS as a significant pollutant, as the Council itself argues that leaves, sticks, twigs, among other long-decaying debris, is a significant contributor to DO demand. While admitting the need for more data, the results from the QUAL2Kw and other analyses are certainly more than "premature."	
WWTP	22	152	TM5	"Further, and as was pointed out in my comment letter on March 16, 2009, the TSS data is highly variable with the discrepancy between predicted and measured TSS values being as much as 223% (at Utah Lake) to within the 40% range in all of the segments approaching 2100 South. That comment still applies, that there are large sources and sinks of TSS that are not well understood, and so require a more thorough investigation before we can develop a useful TMDL that is associated with TSS or TVSS."	This comment seems to refer to the attempt to develop a Mass Balance analysis for pollutants in the Jordan River, published in the WE2 report. There are, however, other sources of error that could account for much of the variability, including not only the span of years covered by the WQ data, but also the limited flow data available at some sites. Errors in flow can produce large errors in loads, as loads are a function of both concentration and flow.	No changes necessary.
WWTP	22	153	TM5	"Similarly, we have commented that the original estimates for phosphorus loads, particularly with regard to the contribution by the POTWs were not accurate. As a consequence, in about May of 2009, the contractor recalculated these loads and adjusted to load downward by about 25% (from 737 tons annually to 520 tons annually). In the latest presentation by the contractor (on the Cirrus FTP site), in about March of 2010, the contractor further reduced these loads to about 429 tons of P annually, a total adjustment downward by about 42%. This reduction is loading from POTWs is substantial. However, in a concomitant fashion, DWQ and its contractors also reduced instream concentrations, so that the result still leaves the POTWs as responsible for ~80% of the total river P load. As with the previous paragraph, large	This comment seems to imply that changes to pollutant load calculations have occurred at random and without any justification other than to maintain a certain level of pollutant loading assigned to WWTPs. There is certainly no hidden agenda or conspiracy to attack the WWTPs. Rather, the State and the contractor are trying to understand the problem and discover a solution to the DO impairments measured in the lower Jordan River. The commenter has been apprised of the reasons for each of the adjustments mentioned. This occurred in numerous ways including direct written response by the State to the commenter, personal communication with the commenter during stakeholder meetings, working with the commenter to utilize data collected by WWTPs, and clear documentation in technical memos that	No changes necessary.

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				variability exists between the predicted and the measured loads at various locations/reaches in the river. We helped to document the accurate loads from the POTWs, but where is the documentation for reduction in the other Jordan River load sources? We request documentation of the calculations used to generate these numbers, as this certainly suggests that as lower loads from the POTWs have been documented, the target of assigning 80% of P loads to the POTWs, remains."	the commenter has possession of. For clarification purposes, the first change was due to a very simple (albeit embarrassing) error in using maximum daily values of Total P concentrations from the WWTPs rather than average daily concentrations . The second adjustment resulted from using the WWTP's own WQ data rather than that collected by the DWQ. A third adjustment resulted from incorporating an extra 2-3 years of data collected by DWQ (2006-2008), providing substantially more values to augment the limited historical data set. The documentation used to generate pollutant loads for other Jordan River sources is provided in *Draft Technical Memo: Updated Pollutant Source Characterization, December 8, 2009*.. This document was submitted to the entire TAC (including the commenter in December 2009. No one is targeting the WWTPs as the "bad guys." Indeed, Leland Myers himself (Central Davis Sewer District), at the biannual Great Salt Lake Issues Forum in Salt Lake City in May 2010 suggested to those assembled that WWTPs would be eager to reduce their loads to whatever the state required; they just need to know what that value should be.	
WWTP	22	154	TM5	"Referring back to the model, the document on page 10 states that 'forcing the model to incorporate additional (prescribed) SOD that is assumed to build up over long periods of time from settling VSS to the sediments…' This is an incorrect assumption as it ignores the potentially considerable contribution coarse particulate organic matter (CPOM) that is carried as bedload as well as the fine particulate organic matter (FPOM) suspended in the water column during spring run-off flows. Both urban and national forest land (in the canyons) undoubtedly contribute	Coarse particulate organic matter (CPOM) may indeed be a significant source of OM. If this is a large contribution with respect to VSS (fine particulate organic matter, or FPOM) needs to be ascertained. VSS is known to settle and does certainly contribute to SOD over long periods of time. There is no time of the year when VSS does not exist and is not settling in the lower Jordan River, therefore, it is correct to say that VSS is responsible, in part, for an elevated SOD. We did not say that VSS is responsible for all of the SOD. With respect to the commenter's Table 1, showing	No changes necessary.

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				large and as yet unmeasured quantities of organic matter ranging from leaf litter, twigs and grass clippings as well as algal fragments from tributaries and Utah Lake. Indeed, because both TSS and TVSS do not diminish among the several sites downstream from the tributaries (i.e. below N. Temple Street; Table 1), there should be no preconceived assumption that settling of suspended VSS is responsible for the elevated SOD. Again, these data suggest that the assumption that settling TVSS is responsible for the elevated SOD is flawed." In the caption for commenter's Table 1: "Note how the concentration and flows from the South Davis South plant appear to dilute existing concentrations in the river."	TSS, TVSS (total VSS), and BOD levels in the lower Jordan River, there are other reasons why VSS may not be declining in the lower Jordan River, including other sources (drains and tributaries entering the lower Jordan River), resuspension, and algal growth. Note also that in the commenter's Table 1 TSS and VSS decline markedly from below the SDSWWTP ("SDSD") to below Burnham Dam, suggesting a role for settlement and solution.	
WWTP	22	155	TM5	With respect to commenter's Table 1: "Alternatively, this information suggests the likelihood that the spring runoff, stormwater, and perhaps even normal flows are carrying large quantities of organic matter in the bedload. This hypothesis needs to be tested before any attempt at attributing the SOD to settling VSS is made. Further, the CPOM delivered with the bedload would contain organic matter that runs the gamut from very refractory, coarse lignins, to more labile simple sugars, amines and small-chain fatty acids. The concentrations of these fractions would be variable seasonally as well as spatially among downstream locations."	None of this suggests a special role for CPOM. FPOM also probably varies in degree of refractoriness. The relative contributions of CPOM and FPOM in different reaches and different seasons are unknown, but there is no reason to believe one contributes more or less to a "bedload" – which is assumed to mean settlement and resuspension.	No changes necessary.
WWTP	22	156	TM5	"The contribution of leaves, twigs or lawn clippings is acknowledged on p. 5, 2nd paragraph. However, the complexity of the composite compounds is generally ignored. For example, on p. 5, bottom paragraph, the document states that: "the conversion of OM to oxygen demand in the	The results of the QUAL2Kw analysis demonstrated that organic matter, rather than simple nutrients, is the main demand on DO in the lower Jordan River. In particular, it was the insoluble components ("Detritus" in the model) that makes the most difference. This organic	No changes necessary.

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				QUAL2Kw model is essentially a 1:1 ratio (i.e. 1.076 g of oxygen consumed by decomposition of 1 g of dead OM or detritus). Therefore BOD data can be used to approximate OM in the absence of more direct measurements of OM such as VSS and chlorophyll a .” I could not find documentation in the User’s Manual or the Theory document for such a relationship, Nor does the 1:1 relationship occur in the co-located data set that we have for 2009. Nor, do I believe, should it. For example, the factor of 1.076 is very similar the well-known oxidation of the simple carbohydrate, glucose (which requires 1.067 g O per g C6H12O6). Just for comparison, NH4 requires 4.6 g of O for oxidation to NO3 and CH4 requires 4 g of O for each g of CH4 oxidation. The point is that even very small (dissolved) and simple oxygen-demanding compounds require much more oxygen than an estimate similar to glucose oxidation. And this is not to mention the myriad complex carbohydrates (i.e. cellulose, which is highly refractory), proteins, lipids, including small chain fatty acids, etc. that occur in nature. Please verify where this conversion is described. And if it is described in the documentation, we suggest that you verify this factor with the model authors.”	matter is measurable as “VSS” (referred to as “TVSS” by the commenter), or the combustible portion of TSS filtered from the water column. It is believed that a significant portion of this VSS settles to the bottom in the slower velocities of the lower Jordan River, there to decompose over a long period of time and contributing to the SOD. This unexpected discovery posed a problem for calculating historical loads and necessary load reductions, however, as VSS has not been routinely measured. The only available measurements were those taken during synoptic events in August and October 2006, February and March 2007, and August 2009. Since VSS is a component of the TSS, a ratio of VSS:TSS was used for sources where VSS had been measured during the synoptic events and for which there was a long term record of TSS. For other sources without that VSS:TSS ratio or without a long term TSS record, but for which BOD had been measured, a ratio was used between the BOD and VSS. This ratio was based on the stoichiometry in the QUAL2Kw model of 2.69 g of O used to oxidize 1 g of C, and 0.4 g of C in each 1 g of Detritus (or VSS). This works out to be 1.076 g of O demanded per 1 g of VSS. Thus, where BOD had been measured, it was possible to assume that there was approximately 1 g of VSS for every 1 g of BOD measured for these sources. This is less than ideal, of course, because the BOD measurement is typically limited to a 5-day period, and for slowly decomposing, highly refractive matter (such as leaves, twigs, etc.), it underestimates the O needed after that time, and would overestimate the VSS. Nevertheless, in the absence of measured VSS, it provides a conservative starting point for estimating VSS from some sources, in particular, storm water, diffuse runoff, and ungaged tributaries. In the	

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					future, VSS will actually be measured and can provide a more accurate assessment of the contribution of these other sources. This data will be incorporated into future load allocations which will be adjusted during subsequent phases of an adaptive implementation approach.	
WWTP	22	157	TM5	"The simple approach, as described in the document, is the likely reason why there is no relationship between BOD and VSS in co-located and co-timed data." "Indeed the bottom line is simply that not all VSS is created equal."	Other reasons for a lack of correlation in the commenter's data on BOD and VSS include the fact that all measurements were in different months and only one year. More importantly, however, is that VSS is, by definition, insoluble, and as such, only contributes to BOD after the more soluble, organic matter has been digested. This may well be after the 5-day period typically used in BOD_5 measurements. With respect to the "bottom line," we have said as much.	No changes necessary.
WWTP	22	158	TM5	"Page 8, bottom paragraph, second sentence 'diurnal changes in pollutant loading to the Jordan River likely exist due to natural and anthropogenic process (e.g. management of wastewater influent and effluent)'. This statement is oversimplified. Large plants have remarkably consistent concentrations of nutrients, BOD and TSS because they have long retention times and feedback processes to maintain stable conditions."	True. Stormwater loading would be a better example of anthropogenic loading that may exhibit fluctuations faster than diurnal frequencies.	No changes necessary.
WWTP	22	159	TM5	"P. 10. 2nd paragraph. 'The QUAL2Kw [model] was used to determine the endpoint concentration of VSS because it incorporates the many ongoing processes that affect DO'. This statement is simply not true. It does not account for bedload quantities of OM that are likely the biggest single source of OM – at least during spring – which has not been measured. The contractor's assumptions and omitting this important source of OM is not	QUAL2Kw does incorporate "many processes," although it may not include all processes or include all with the same level of accuracy and certainty. There is no data – quantitative or anecdotal – that suggests that "bedload quantities of OM…are likely the biggest source of OM." Better data on resuspension of various forms of OM would be invaluable.	No changes necessary.

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				acceptable."		
WWTP	22	159	TM5	"Further, one key question remains, with the problem of 'leaping' from TSS to TVSS and from BOD to TVSS, why not just base the OM on measures of BOD or CBOD and SOD? After reviewing The Council's data, there is [no] relationship between TVSS and BOD. Therefore using TVSS as a surrogate for the oxygen-demanding potential has no scientific basis in this situation, as for reasons explained above. Also, because of the short transit time between Utah Lake andGSL (3.5 d), a measure of CBOD and SOD, as 'model-adjusters' is much more applicable because the greatest oxygen loss in such measurements occurs in the first 2-3 days (first order kinetics). Finally, because BOD (and TVSS) does not vary with distance downstream, and because of the relatively small proportion of water column oxygen depletion, as measured by Dr. Goel, it again seems misdirected to try to apply a TMDL endpoint to a suspended fraction of OM that has widely varying concentrations of TVSS while much more stable concentrations of actual BOD occur. Your assumed connections between TVSS and BOD simply aren't there. What is missing are the seasonal loads of both suspended and bedload OM that finally settles or is retained as flows diminish downstream from 2100 S. Prescribing SOD and perhaps BOD reductions may be appropriate but not as related to TVSS. Preparation of the TMDL should cease until these important seasonal loads are characterized and quantified."	There are, admittedly, limited data on BOD and VSS, both in the DWQ synoptic data set and from the Council. There is, however, very good reason to "leap" from TSS to VSS as the target pollutant, because the other component of TSS, inorganic suspended solids (ISS), generally creates only a very small demand on DO. Preparation of the TMDL cannot "cease" until all is known, but the TMDL can move forward in innovative ways to begin correcting reasonably well-understood sources of pollutants, even as more data are gathered and relationships analyzed.	No changes necessary.
WWTP	22	160	TM5	"P. 10. Third paragraph states: 'The same endpoint was used for both existing and future load allocations because it is the concentration rather than the load of VSS that affects the amount of	Additional SOD was prescribed within the QUAL2Kw model because the model only calculates SOD resulting from detritus created and settling within the model period (6 days).	No changes necessary.

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				bacterial decomposition of OM and consumption of DO.' This statement is also flawed. As described in the QUAL2Kw documentations: Prescribing SOD was required because organic matter was delivered to a specific reach in other than a steady state condition. This would imply that settling or bedload OM retention in greater amounts had occurred previously and therefore, DO improvement based upon monthly average concentrations would indeed NOT be valid, but that the sediment loading is affected by retention, followed by physical abrasion and breaking apart of CPOM, as well as settling of FPOM, the greatest quantities of delivery of which, is occurring during spring, and both of which are followed by oxygen-consuming bacterial decomposition. This all could take weeks, to months, to years. The interpretation of these processes in the document needs to be expanded and corrected. This principle is [alluded] to in paragraph 5 of P. 10. However, it is certainly a wrong assumption that delivery and accumulation of OM to this reach occurs equally among all months. We all know that western streams, characterized by large snowmelt runoff, and infrequent storm events, simply do not behave in a steady-state pattern. This needs to be much more carefully addressed."	Measured values of SOD are considerably higher, which suggests that OM beyond that which grows during the model run is entering from upstream. This OM occurs throughout the year in varying concentrations and settles to the bottom where it can decay over a very long time, if necessary. The "steady state" condition (although variable in magnitude) is one of continuing decomposition of material continually refreshed from upstream as well as instream sources. We are certain that OM loads and concentrations are not equal in all months, but assigning a constant concentration is a reasonable starting point. And, again, data on CPOM and FPOM are limited. However, a more responsible alternative to ceasing the TMDL is to devise a flexible and adaptive approach as new knowledge is gathered.	
WWTP	22	161	TM5	"Similarly, paragraph 1.2.3.3 Organic Matter Data states 'Available measurements of OM or data that can be used to assess OM in the Jordan River are essentially limited to VSS, BOD, and TSS'. This is very true and yet, unacceptable - as this database needs to be expanded to include estimates of CPOM and FPOM in the spring and as a component of the bedload." "This condition further renders the next section,	As addressed above, data from both DWQ and the Council are limited, but reasonable relationships and progress toward meeting the WQ standards are possible. The TMDL loadings are, in fact, based on measurements of SOD, which is why prescribed SOD was added to the QUAL2Kw model calibration.	No changes necessary.

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				2.1 EXISTING LOADS AND LOAD REDUCTIONS-A VSS MODEL, inaccurate and unusable. While there is a relationship between TVSS and TSS, there is simply no defined relationship between TVSS and BOD (Fig. 2). Which again, begs the question, why are the TMDL loadings based on TVSS and not direct measures of oxygen depletion (i.e. CBOD and SOD)?"		
WWTP	22	162	TM5	"P. 10. Paragraph 5. The document states, 'The period prior to the critical condition occurring in August that is necessary for this buildup is unknown, but as benthic processes are continually decomposing the settled OM, it is likely that the accumulation process occurs almost year round. As a result, the same endpoint used in calculation of the permissible load for August is applied equally to every month'. Again, for reasons described above, this is an inaccurate assumption. The great majority of settlable/ retainable OM delivery likely occurs in spring and summer because of high surface diffuse runoff/flows and high summer blooms in Utah Lake."	The details of how much, what kind, and the seasonality of OM accumulation are still uncertain. It is certainly possible, even plausible, that the peak loading of OM occurs in spring and summer. Storm events, algal blooms, rain-on-snow events, and other phenomena are correlated to season. That doesn't obviate the need for year round reductions, but more research is clearly needed to refine the seasonality of load allocations. Some progress is nevertheless possible even before these data are available, and a year round endpoint is the more conservative approach and justifiable for a river that has suffered from impairment for many years.	No changes necessary.
WWTP	22	163	TM5	"P. 17. Table 2. While the TVSS from Utah Lake is approximately 6X that of the next largest contributor (i.e. Central Valley WWTP), [t]he table assumes that the residual TVSS at 2100 South is only 8% of that at the headwaters. This assumes an extremely large quantity has settled out. Recognizing the uniqueness of the source water, massive diversions and return flows and channel conditions, this should be verified with literature values and confirmed with direct measurements, not just in the inputs or default values in the QUAL2Kw model."	Yes, it should.	Seek supporting literature on settlement and solution rates of VSS.

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WWTP	22	164	TM5	"Proportional Load Allocation: As described above, the use of monthly permissible concentrations is unworkable because it does not reflect natural seasonal flows and loadings. This approach needs to be abandoned and replaced by accurate seasonal loads of TVSS, BOD and bedload of OM and their retention and settling in order to accurately reflect loadings at 2100 South and downstream."	How workable it is will be investigated in the next phase that includes considerations of cost and practicability.	No changes necessary.
WWTP	22	165	TM5	"In addition, the report assumes that no change will take place in flow or concentration at Utah Lake. This is simply not true. For a small fraction of the costs incurred in reducing the NPS and point sources to the proposed amount, a semi-permeable causeway surrounding the Utah Lake outlet could be constructed. For example, a causeway with the radius of 0.25 mile could be constructed, rotenoned to remove all the carp, and would minimize the extensive wave action that suspends the sediment and contributes to the elevated TSS and TVSS."	Good idea and perhaps worth investigating.	No changes necessary.
WWTP	22	166	TM5	"The report states that all data used to calculate monthly VSS loads, including VSS:TSS ratios and BOD, TSS, and VSS loads are available on request in the form of an MS Excel spreadsheet. The details of critical assumptions for calculating VSS are in Appendix B. We are making that request at this time."	The spreadsheet will be made available with this response to comments.	No changes necessary.
WWTP	22	167	TM5	"Page 11, 12 and 13. Section 2.1.2. The document states: 'Organic matter is lost from the water column from three major sources: settlement, solution, and consumption and bacterial decomposition. The latter factor was not considered significant for the length of the Jordan River, based on rates of bacterial growth in the literature supporting QUAL2Kw.' What? This	The results of the QUAL2Kw model lead to the conclusion that SOD, resulting from settling organic matter, is responsible for the majority of the DO demand in the lower Jordan River. The VSS model was used to estimate how much VSS might reach 2100 South from particular sources. Travel time from Utah Lake is approximately 45 hours, but most sources of VSS are within 24	No changes necessary.

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				statement is very misleading. The whole document is based on bacterial decomposition. As stated above, the settling rates are crucial to the success of this whole exercise. These rates need to be verified." "Table 1 contains a summary of BOD values at select sites within the impaired reaches. Notice how BOD in the river is similar to BOD values even measured in whole effluent of the South Davis South plant. Certainly, the statement, and the approach, needs to be reconsidered to include bacterial assimilation of organic matter."	hours of 2100 South. BOD results from both VSS and soluble organic matter. Whereas most of the immediate BOD_5 results from soluble cBOD, probably little of the VSS is consumed by bacteria in these short transit times. It is of interest in the commenter's Table 1 that concentrations of BOD_5 from SDSWWTP are more than those in the river immediately upstream.	
WWTP	22	168	TM5	"p.13 4th paragraph. As described above, there is only a moderate relationship between VSS and TSS. But there is absolutely no predictable relationship between TVSS and BOD. Hence any correction factor is inappropriate because we do not know what the relationship is. Not only does this include the fact that no detritus:TVSS:BOD relationship exists but the proportional load allocation is based on a faulty premise of equal monthly loads – This is just not the case, otherwise, why did we have to prescribe additional SOD in the model. Also, as mentioned above, with such a critical component of this whole exercise being dependant on the settling rates, this value, once again, needs to be verified."	The commenter's figure "1a." shows a correlation between VSS and TSS with an R_2 of 0.7321. This relationship is much stronger than "moderate." The lack of relationship between VSS and BOD in the commenter's data could well be due to the complex nature of the material that makes up the VSS, as VSS does not include the more soluble components of organic matter which would be the first to break down and contribute to BOD. The equally monthly proportional load allocations were not based on equal monthly inputs but rather an attempt to based load reductions on monthly loads, a function of both concentration and flow, so as to begin with a more uniform WQ standard that could be applied year round.	No changes necessary.
WWTP	22	169	TM5	"p. 13. Section 2.1.4. A key assumption is that no reasonable changes would take place in flow or concentration at Utah Lake. Each of the other sources upstream and downstream of 2100 South was considered reducible. This should not be a key assumption. With estimates ranging from 10s to 100s of millions of dollars to acquire the ownership or easement rights to private property, construction of semi-permeable causeway that	The beginning assumption of not being able to reduce the loading from Utah Lake was in part due to that body of water being governed by a separate TMDL process. In the future, it may well be possible to also include load reductions for Utah Lake. In the meantime, a phased implementation of a Jordan River TMDL will provide some latitude in load allocations as more is learned about patterns and sources of loading, as well as	No changes necessary.

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				surrounds the Utah Lake outlet is well within the range of possibilities."	effectiveness of reduction strategies.	
WWTP	22	170	TM5	"p. 14. VSS loading was estimated using the same VSS:TSS or VSS:BOD ratios as in the existing load analysis. Again, we request the original data and the calculations that were used to create this scenario. If it's just based on the four sampling events mentioned on P. 13, it's just not complete enough, as there are no data for spring or early summer flows and loads."	As stated in the memo, it was based on the four synoptic events of August 2006, October 2006, February-March 2007, and August 2009. Clearly, additional data is needed for spring and early summer conditions, as well as for different kinds of annual precipitation patterns. And again, the proportional load allocation approach was only a beginning.	No changes necessary.
WWTP	22	171	TM5	"p. 14. Section 2.2.2. The document states: North Jordan Canal, the last diversion on the Jordan River upstream of 2100 South…. What about the Brighton Dam?"	Diversion flows were not available when canal data was originally assembled. New data will be sought for the diversion at Brighton Dam and incorporated into the final model of VSS load allocations.	Investigate flows and loads diverted at Brighton Canal.
WWTP	22	172	TM5	"p. 15. 1st paragraph. The document states: 'Since various forms of inherent error mentioned above resulted in a discrepancy between calculated loads from sources and calculated load at 2100 South from measurements of TSS at 2100 South, it was necessary to derive a correction factor for unreduced future loads. This factor was derived for each month …' As mentioned above, calculations based on dividing annual loads into monthly loads, and specified as concentrations, is not correct because monthly loads will vary dramatically with season. These loads could be calculated on a monthly basis, but only after loads (both suspended and bedloads) that accompany seasonal flows are determined."	Loads were calculated on a monthly basis, albeit using assumptions to interpolate between the months when synoptic data was available. The correction factor was necessary to estimate future load reductions for a "no action" condition from which to calculate a load allocation because no actual measurements of future loads were possible.	No changes necessary.
WWTP	22	173	TM5	"p. 16. [T]he document states: irrigation return flows contribute about 310,000 kg/yr of VSS to the lower Jordan River. How is this calculated? Does this include return flows to the tributaries	These values were calculated from BOD measurements and estimates of return flows in the Work Element 2 report. They do not consider exchanges; that is being incorporated into the next	No changes necessary.

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				from the water exchanges."	phase for final calculations.	
WWTP	22	174	TM5	"Page 17. How much of Table 2 consists of actual data on TVSS vs speculation on the loads derived from the four sampling events discussed on p. 13, particularly for each load source? This should be clearly stated in the table heading. The actual data should at least be included in the appendices, with calculations and error bars, significance values or R values included on all results."	These calculations were, of necessity, based on available data and assumptions. All of the assumptions were disclosed in an appendix. The data are available on request, but are too extensive to be reasonably published in an appendix.	No changes necessary.
WWTP	22	175	TM5	"Page 18. Table 3. This table is absolute "pie-in-the-sky" wishful thinking. It reflects the lack of knowledge and understanding of spring flows, accompanying bedload of OM, as well as the TVSS. Once again, because the prescription in the model was to enhance SOD – and which was performed according to Dr. Goel's measurements, this should be a load-based allocation rather that a concentration-based allocation. From all of the existing data, there is no supporting evidence that the TVSS found in the water column settles to the bottom at any location below 2100 South! This is even true for the Cyanobacteria from Utah Lake and the diatoms that Rushforth found being scoured from the substrate above 2100 S. We simply need more research to understand what is going on."	It does reflect a number of assumptions and very limited data, but is hardly "pie-in-the-sky." More data is needed but WQ has been so compromised by WWTPs and other sources for so long that action must be initiated now. The allocation is based on a concentration, but flows to the lower Jordan River are regulated within a very constant range, which makes for a relatively constant loading.	No changes necessary.
WWTP	22	176	TM5	"Nowhere in the rules or any supporting documentation, is the explanation for the site-specific 24- minimum standard of 4. mg/L presented. After quizzing at least three current and past DWQ staff members as to why the Jordan River should have a site-specific DO standard, no one has an answer. This justification needs to be explained or the site-specific standard needs to be removed."	A TMDL is based on accepted WQ standards. Changing that standard is not within the scope of a TMDL.	No changes necessary.

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WWTP	22	177	TM5	"Similarly, as I have stated in previous comments, nowhere in the rules or recent 305(b) reports is a description of how the 30-day or the 7-day average DO standards are to be assessed (both are listed at 5.5 mg L-1 for the Jordan River whereas the state-wide 3B is 5.5 for the 30-day and 4.0 for the 7-day averages, respectively). Even so, the report only refers to the 30-day average. And, as it is referred to in the report (i.e. "the percentage of violations"), it is treated as the de facto 24-hr minimum rather than representing the true 30-day average DO in the Jordan River (i.e. there are no mentions of the 24 hr minimum of 4.0 L-1 or even the more-defensible statewide value of 3.0 mg L-1). Having worked with these standards myself (authoring the 'Lakes' Chapter of the 305(b) for 9 years, I believe that, as the standard indicates, within any 30-day monitoring period, the average dissolved oxygen concentration, based upon diel measurements (equal night-time and day-time sampling intervals) needs to be above the 5.5 mg L-1 standard. Otherwise, this standard is misapplied. Indeed, EPA's guidelines on this subject (EPA440/5-86-003 Ambient Water quality Criteria for Dissolved Oxygen, April 1986), explain the need to capture the peak afternoon DO and the early morning dip and then taking the average. This is to be continued for each of the 7 days and then averaging the 7 one-day means in order to obtain the actual 7-day average. This should be the guiding protocol. Therefore, as it is currently presented, the display of monthly data and the labeling of Figure 4.1 (page 93 of the Element 2 Report and many times elsewhere), is highly misleading by stating that the figure reports 'Means and Chronic Violations' of dissolved oxygen. The Division needs to reassess the dissolved oxygen data for the Jordan River using	It is impossible to create new historical data. These analyses have been done with all of the available data and even invited and included data from non-DWQ sources, including WWTPs. Assumptions and methods have been transparent and judged reasonable by the Technical Advisory Committee, scientists, and others. Going forward, it may be advisable to revisit WQ standards or data methods, but further delay in taking action is not acceptable.	No changes necessary.

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				an accurate interpretation of the rule and EPA guidelines."		
WWTP	22	178	TM5	"Even as it is now written, and if DWQ were to apply the 10% rule for the 24 hour instantaneous DO violations based upon the diel samples that have been collected since 2006, the assessment would have to conclude that segments 2 and 3 are fully supporting because, according to our 2009 data and data shown in the element 2 Report, very few (far less than 10% of the hundreds of data points collected throughout the 3-4 day sampling period), early-morning readings (at 30 minute intervals) violated the instantaneous value of 4.0 (our data) and no data points in the Element 2 report indicated violation of the 4.0 standard. Similarly if the average DO of the diel sampling were to be calculated, the means would demonstrate that the average DO does not even come close to the 30-day average of 5.5 mg L-1. Just draw a line along the 5.5 mg L-1 concentration on any of the diel graphs presented in the Element 2 report and you will see that the 24-hr average of the sine waves are well above the 5.5 mg L-1 30-day average. Using the available data would negate any decision of impairment in at least the last 5 years for segments 2 and 3. Please review and clarify the assessment method for the 30-day average DO. I believe you will come to the same conclusion as I have for both the assessment protocol and the more serious question whether there is even a DO impairment in the Jordan River at all."	The "10% rule" was developed to apply to the types of WQ methods and data that have historically been collected. The need to sample many places with limited field crews has made it impossible to synchronize times and dates. It is not applicable to high frequency, short term data collection events such as diurnal sampling from an unattended sonde.	No changes necessary.
WWTP	22	179	TM5	"In the final load analysis, it is assumed that all assigned sources will be able to reduce their respective loads. However, as per quotations expressed in the annual Jordan River Watershed Council meeting, estimates for restoring the Jordan	Fully understanding such a large and dynamic system as the Jordan River watershed will undoubtedly take longer than a mere 2-3 years. Yet, WQ has been an intractable problem for a long time. Rather than wait for a complete data set	No changes necessary.

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				River water quality and corridor range to $700,000,000 or greater. With any sense of reality, achieving this goal is going to be extremely difficult and time-consuming. Even in the near future, another 2-3 years of data will be necessary to fully understand the flows and monthly and seasonal loadings from the many sources that have been identified – and this doesn't include the need and the options to control the TSS and TVSS from Utah Lake. Together, with the present document and its abundance of questionable assumptions and paucity of relevant data, this information points to the need of a watershed approach to solve these many issues that span from Utah Lake to the Great Salt Lake."	and adopt a completely defined set of corrections ("standard implementation"), it may be more efficacious to better understand the limitations on the data that exists, and design actions and adapt them as understanding increases ("adaptive implementation" and a phased approach).	
WWTP	22	180	TM5	"Therefore, as we recognize the need for such a watershed approach, The Council suggests that solving the immediate problem of low DO below 2100 S. can be accomplished expeditiously and efficiently with the use aeration. This will remove the few DO violations that occur and fulfill the immediate requirements of the TMDL while providing the time necessary to more fully understand the composition, mode of transport and relative contribution to the DO sag. In turn this will provide for a more holistic watershed approach with more accurate estimates of sources and realistic goals in load reductions that will ultimately resolve the DO issue below 2100 S."	The need to reduce organic matter loading to the lower Jordan River and the selected endpoint for VSS was validated by the QUAL2Kw model in its current calibration, which was accepted by the technical review committee. Exact load reductions are uncertain because of the limited availability of data on organic matter loading but, rather than delay, this suggests a phased approach where some improvements can be sought even as more information is gathered. Artificial aeration is not an acceptable solution at this point because it has not yet been demonstrated that adequate VSS reductions cannot be achieved.	No changes necessary.
WWTP	23	200	TM5	Reach Worksheet: Weir Depths: These values seem to be very low. Many of the values are 0.1 meters which is just a few inches. Observations have shown that the drop is more than that in many reaches which have that value.	Weir depths were based on field measurements made by DWQ staff. Several of the weirs and dams in the Jordan River are at channel bed elevation, and only back-up water when the gates are closed. Requests of that specific data be provided if there are known discrepancies.	No changes necessary.

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WWTP	23	201	TM5	Reach Worksheet: Manning Coefficient: This value is not easy to acquire. It would be helpful to know how these numbers were generated.	Manning coefficients were obtained from HEC-RAS model of Jordan River, which has detailed channel geometry data, including Mannings coefficient. Refer to *Lower Jordan River TMDL: Work Element 4 – Flow and Water Quality Modeling Report* (Stantec Consulting, 2006) for more detailed explanation.	No changes necessary.
WWTP	23	202	TM5	Reach Worksheet: Bottom Algae Coverage: These values seem to be best professional judgment. What were the criteria developed to get these values?	Bottom algae coverage was a calibration parameter. Once phytoplankton concentration was calibrated, bottom algae coverage was adjusted to reflect the primary productivity observed in the DO diel range. Limited periphyton data collected by DWQ staff was also referenced.	No changes necessary.
WWTP	23	203	TM5	Reach Worksheet: Bottom SOD Coverage: The entire length of the river has a 100% value. It would seem that there would be reaches that have other values as a function of the bottom condition. For, example, the upper higher gradient portions of the river could have a lower percentage due to the higher propensity for rocks and scoured bottom.	Use of 100% coverage allowed the model to estimate SOD using the diagenesis routine without restricting SOD coverage. Calibrated the SOD amounts using data collected by the University of Utah (Dr. Goel). SOD measurements from summer 2009 indicate SOD throughout Jordan River, with higher values in the lower gradient segments.	No changes necessary.
WWTP	23	204	TM5	Reach Worksheet: Prescribed SOD: Do these values match those from studies conducted by University of Utah studies? It seems that a higher SOD prescribed value would help bring down the DO in the lower reaches of the river. Have any studies been done on the upper reaches?	Calibrated the SOD amounts using data collected by the University of Utah. Prescribed SOD was added to the model so that simulated SOD would better match observed values.	No changes necessary.
WWTP	23	205	TM5	Headwater Sheet: Detritus: How was the detritus values measured?	Detritus is dead organic matter in QUAL2Kw. For the synoptic surveys, detritus was calculated by subtracting the live algal biomass (as estimated by chlorophyll a and stoichiometry) from the volatile suspended solids (VSS).	No changes necessary.
WWTP	23	206	TM5	Rates Sheet: Inorganic Solids: Settling Velocity: It seems that this value is very low to the point that	Observed ISS concentrations remained relatively uniform through the Jordan River, even though	No changes necessary.

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				there is essentially no settling. If it were that low it seems there would not be a requirement that the river be dredged on a frequent basis? Please comment?	groundwater and POTW effluent have very low ISS concentration. Therefore, a low settling velocity was selected for ISS to reflect the observed data.	
WWTP	23	207	TM5	Rates Sheet: Light Model: The new calibration changed from the Half saturation to the Smith algorithms. Please explain why this was done and what is the effect.	The Smith model generally results in more algal growth than the half-saturation model at the same light level. Phytoplankton was generally under-simulated in the Jordan River; therefore, Smith model was selected to increase growth.	No changes necessary.
WWTP	23	208	TM5	"Other constants: The Global Rate Parameters in the Rates worksheet have had significant changes in their values since the 12/15/2009 calibration. For example, the Slow BOD was decreased 5 fold. It seems that this may have been done to accommodate the different type of POTW effluent. If this is the case, the concentrations of Fast BOD and Slow BOD need to be re-verified in the Point Sources sheet. The same logic applies to the Fast BOD values. Please explain."	Based on discussion at the collaborative calibration workshop held on 12/15/2009, it was agreed that fast BOD should have a higher decay rate than slow BOD. Slow BOD is more complex organic material from the tributaries and Utah Lake, whereas fast BOD is more readily degradable POTW effluent. Slow and fast BOD were combined and compared to observed values in the ScBOD graph.	No changes necessary.
WWTP	23	209	TM5	"Other constants: The nitrate denitrification was significantly decreased. Why was that that changes made and what was the effect on DO in the output? This comment also applies to the Organic P: Hydrolysis change."	The nitrate and organic phosphorus rate parameters were adjusted based on feedback from the calibration workshop. Denitrification was decreased so that simulated nitrate concentrations better matched observed. Organic P hydrolysis was modified to more accurately simulate the organic versus inorganic speciation. Neither rate had a significant impact on simulated DO.	No changes necessary.
WWTP	23	210	TM5	"Other constants: It would be very useful to all if the Global Rate Parameters would give the source and reason for the chosen value for each parameter. Since the Model is based upon DO, it would be helpful to indicate what percent of movement of a parameter would cause a subsequent movement in DO at the low point in	A sensitivity analysis was previously conducted: refer to *Jordan River TMDL: QUAL2K Model Parameter Sensitivity Analysis Report* (Stantec Consulting, 2008) for detailed description of methodology and results. The results of the sensitivity analysis were used to inform model parameter adjustment during the calibration of the	An uncertainty analysis on the calibrated model is scheduled to be completed in order to develop confidence limits for selected model parameters and model input. Explicitly quantifying the error in the model will inform the use of the model as a decision support tool for the load allocation. Methodology and results of the uncertainty

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				the system. This type of sensitivity analysis will lend credence to the entire process of choosing constant parameters for stakeholders and especially those who will be directly affected by the results of the modeling."	model.	analysis will be documented in a technical memorandum.
WWTP	23	211	TM5	"Model Runs: After downloading the model from the ftp:// site I viewed the graph of the DO curve. [#1]. I then "ran" the program and viewed the DO curve [#2]. I was surprised to see that the graphs were different. Brian Dixon explained that the model had to be run (the six day iterations) to give the "correct graph". Nevertheless, #1 has a much better fit to the calibration field data than does #2. I am still wondering why second run is the 'correct' graph."	Figure #1 is the correct DO curve from the final calibration model. Any change to the model inputs and parameters could result in a change to the DO output. We request that the commenter verify that all inputs are correct.	No changes necessary.
WWTP	23	212	TM5	"Model Runs: I entered 12/15/2009 constants into the Model and ran it [#4]. I noticed a higher DO response in the upper reaches of the river. It seems that the new constants are an improvement due to the proximity to the saturation values. An explanation of why the model behaves this way would be helpful."	The primary adjustment that was made was reducing the bottom algae coverage. Greater algal growth (whether phytoplankton or periphyton) results in a higher mean and diel range in DO. The algal growth was reduced, which lowered the mean DO closer to saturation, but also reduced the diel range.	No changes necessary.
WWTP	23	213	TM5	"Model Runs: I took the "correct" model and then reduced the flow from the POTWs [#5]. There was a significant reduction in the predicted value for DO, however the predicted diurnal swing became excessive. How is this explained?"	Final setup, calibration, and application of the QUAL2Kw model were reviewed by a technical committee and the results have been documented along with the electronic version of the model. We have sought and can respond to comments about these model runs, but are not in a position to review or comment on other variations created by other parties.	No changes necessary.
WWTP	23	214	TM5	"Model Runs: From the discussion of the TMDL outputs, it seems that the consultants are moving to a VSS controlled target for the endpoint. Indeed, a 1.8 mg/l VSS at 2100 South was discussed in the	Final setup, calibration, and application of the QUAL2Kw model were reviewed by a technical committee and the results have been documented along with the electronic version of the model. We	No changes necessary.

Table 1. Response to comments received on technical memos on Jordan TMDL as of March 11, 2010.

Commenter Type	Letter Number	Comment Number	Comment Resource Code	Comment	Response to Comment	Resultant Change to Document or Analysis
				presentations given at DWQ on Thursday, April 22, 2010. Since VSS is a combination of Phytoplankton and Detritus and since the POTWs have no output of Phytoplankton it stands to reason that a reduction of Detritus from the POTWs should be important in raising the DO in the lower reaches of the river. I made that run [#7] and was unable to show any significant effect on the DO in the lower reaches of the river. Why would that be?"	have sought and can respond to comments about these model runs, but are not in a position to review or comment on other variations created by other parties.	
WWTP	23	215	TM5	"Model Runs: Also, at the Thursday meeting, there was a 1:1 ratio suggested for VSS and BOD. An evaluation of data obtained from Theron Miller shows that this is not the case. This concept needs to be fully discussed."	The 1:1 ratio for VSS:BOD is based on the stoichiometry assumed in the QUAL2Kw model (40g carbon:7.2g nitrogen:1g phosphorus;100g detritus and 2.69g oxygen per 1g carbon for oxidation). Clearly, organic matter in the natural environment varies considerably from a single, assumed stoichiometry; however, it was deemed a reasonable starting point in lieu of measured ratios. See response to comment #156 for a more extensive discussion.	No changes necessary.
WWTP	23	216	TM5	Moellmer "Figure 2 Dissolved Oxygen with Original Model Inputs [August Final Constants]: This graph show the results of 'running' the model with all input parameters and constants as received from the Stantec/Cirrus ftp site. These are the 'Final' values as indicated in the Global rate parameters" spreadsheet supplied by DWQ at the April TAC meeting. Comparison with #1 shows an elevation of the predicted dissolved oxygen in the lower reaches. This predicted elevation moves the curve upward above the observed data used for the calibration."	Final setup, calibration, and application of the QUAL2Kw model were reviewed by a technical committee and the results have been documented along with the electronic version of the model. We have sought and can respond to comments about these model runs, but are not in a position to review or comment on other variations created by other parties.	No changes necessary.
WWTP	23	217	TM5	Moellmer "Figure 4 – Dissolved Oxygen with 12/15/2009 Constants: As a part of the calibration process various parameters are adjusted to force	Final setup, calibration, and application of the QUAL2Kw model were reviewed by a technical committee and the results have been documented	No changes necessary.

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Commenter Type	Letter Number	Comment Number	Comment Resource Code	Comment	Response to Comment	Resultant Change to Document or Analysis
				the model to respond to the data used for the calibration. This graph of dissolved oxygen is such a run in which the calibration constants from 12/15/2009 were used to calibrate the model."	along with the electronic version of the model. We have sought and can respond to comments about these model runs, but are not in a position to review or comment on other variations created by other parties.	
WWTP	23	218	TM5	Moellmer "Figure 5 Dissolved Oxygen Using Final Calibration Constants and 50% POTW Flow: This graph reflects the change in the dissolved oxygen if the POTW's removed 50% of the flow from their discharges. The lowest point in the graph is much higher when compared to where the treatment facilities flow values are those used for the final calibration. This shows that removal of flow will positively affect the lower dissolved oxygen sag observed in Fig. 2."	Final setup, calibration, and application of the QUAL2Kw model were reviewed by a technical committee and the results have been documented along with the electronic version of the model. We have sought and can respond to comments about these model runs, but are not in a position to review or comment on other variations created by other parties.	No changes necessary.
WWTP	23	219	TM5	Moellmer "Figure 6 Dissolved Oxygen Using Final Calibration Constants: 50% POTW Flow, BOD, and Detritus: Removing 50% of the flow showed significant improvement in the dissolved oxygen conditions of the river. This graph continues by removing 50% of the BOD and Detritus in the remaining flow that is discharged to the river. The model run indicated no significant change in the DO sag. This is not expected and further modeling will be done to further evaluate the effect of BOD and Detritus removal from the effluent of the POTWs."	Final setup, calibration, and application of the QUAL2Kw model were reviewed by a technical committee and the results have been documented along with the electronic version of the model. We have sought and can respond to comments about these model runs, but are not in a position to review or comment on other variations created by other parties.	No changes necessary.
WWTP	23	220	TM5	Moellmer "Figure 7 Dissolved Oxygen Using Final Calibration Constants: 100% POTW Flow and 50% of BOD & Detritus: In this graph, the POTW flow is stet at 100% with the DO and Detritus values set at 50% of normal. We see that this graph is essentially equivalent to Fig.2 showing that the effect of removing 50% of the organic material in the discharge is minimal to a	Final setup, calibration, and application of the QUAL2Kw model were reviewed by a technical committee and the results have been documented along with the electronic version of the model. We have sought and can respond to comments about these model runs, but are not in a position to review or comment on other variations created by other parties.	No changes necessary.

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				50% reduction of POTW flow. As indicated in the notes on Figure 6, more computer runs need to be done to evaluate this effect."		
WWTP	23	221	TM5	Moellmer "Figure 8 Dissolved Oxygen Using Moellmer's DWQ Model with values from previous studies (Borup, BYU).: Here we diverge from the Stantec/Cirrus calibration model and use December 2009 DWQ model, data, and constants. The data for flows is 7 day 10 year values from the last 10 years of data on 'Blue Fish'. The dissolved oxygen data points are averages for the 10 year period."	Final setup, calibration, and application of the QUAL2Kw model were reviewed by a technical committee and the results have been documented along with the electronic version of the model. We have sought and can respond to comments about these model runs, but are not in a position to review or comment on other variations created by other parties.	No changes necessary.
WWTP	23	222	TM5	Moellmer "Figure 9 Dissolved Oxygen Using Moellmer's DWQ Model with Stantec/Cirrus global rate parameters as used in the August 2009 Calibration.: This graph takes the Moellmer DWQ model and replaces the global rate parameters with those from the Stantec/Cirrus August Calibration. Essentially what this does is to take the 'Blue Fish' data used by DWQ, the 7Q10 flows along with the calibration rates and evaluates the effect. Here, the results are very similar to Fig. 8, however, we see a slight lowering of the predicted curve. The significance occurs along the 4mg/l control line where this run shows the D.O. lower."	Final setup, calibration, and application of the QUAL2Kw model were reviewed by a technical committee and the results have been documented along with the electronic version of the model. We have sought and can respond to comments about these model runs, but are not in a position to review or comment on other variations created by other parties.	No changes necessary.

Table 2. Letters received from TAC members and public.				
Letter Number	**Responder Type**	**Response Type**	**Name**	**Organization(s)**
1	WWTP	DWQ Compilation 1	Lee Rawlings	South Valley Water Reclamation Facility
2	Government	DWQ Compilation 1	Marian Hubbard	Jordan River Watershed Council/ Salt Lake County
3	Government	DWQ Compilation 1	Briant Kimball	USGS
4	Organization	DWQ Compilation 1	Lynn de Freitas, Merritt Frey, Wayne Martinson, Bruce Waddell	Friends of Great Salt Lake; River Network; National Audubon Society; Lake Front Gun, Fur and Reclamation Club
5	University	DWQ Compilation 1	R. Ryan Dupont	Utah Water Research Laboratory
6	Government	DWQ Compilation 2	Briant Kimball	USGS
7	WWTP	DWQ Compilation 2	Lee Rawlings	South Valley Water Reclamation Facility
8	Organization	DWQ Compilation 2	Bruce Waddell	Lake Front Gun, Fur and Reclamation Club
9	Government	DWQ Compilation 3	Sandra Spence	USEPA, Region 8
10	Government	DWQ Compilation 3	Briant Kimball	USGS
11	Government	DWQ Compilation 3	Greg Williams	Utah Division of Water Resources
12	Government	DWQ Compilation 3	Florence Reynolds	Salt Lake City Public Utilities
13	Individual	DWQ Compilation 3	Dan Potts	
14	Organization	DWQ Compilation 3	Bruce Waddell, Wayne Martinson, Lynn de Freitas	Lake Front Gun, Fur and Reclamation Club; National Audubon Society; Friends of Great Salt Lake
15	WWTP	DWQ Compilation 3	Lee Rawlings	South Valley Water Reclamation Facility
16	Government	DWQ Compilation 4, May 19, 2010	Florence Reynolds	Salt Lake City Public Utilities

17	WWTP	DWQ Compilation 4, May 19, 2010	Lee Rawlings	South Valley Water Reclamation Facility
18	Organization	DWQ Compilation 4, May 19, 2010	Wayne Martinson, Lynn de Freitas	National Audubon Society; Friends of Great Salt Lake
19	Government	DWQ Compilation 4, May 19, 2010	Briant Kimball	USGS
20	Government	DWQ Compilation 4, May 19, 2010	Sandra Spence	EPA Region 8
21	WWTP	DWQ Compilation 4, May 19, 2010	POTW Jordan River Farmington Bay Water Quality Council, represented by: Garland Mayne, J. Newman, K Fisher, Dale Christensen, Dal Wayment, Leland Myers, Kevin Cowan	South Valley Sewer District, South Valley WRF, Central Valley WRF, Salt Lake City, South Davis Sewer District, Central Davis Sewer District, North Davis Sewer District (respectively)
22	WWTP	DWQ Compilation 4, May 19, 2010	Theron Miller	Representing POTW Jordan River Farmington Bay Water Quality Council
23	WWTP	DWQ Compilation 4, May 19, 2010	William Moellmer	Representing Jordan River Farmington Bay Water Quality Council

Table 3. Comment Codes	
Code	**Subject of Comment**
TM1	Draft Technical Memo: Updated Pollutant Source Characterization, December 8, 2009
TM2	Draft Technical Memo: Future Loads and TMDL Compliance Points, December 9, 2009
TM3	Draft Technical Memo: Update to Linkage Analysis Related to Dissolved Oxygen in the Lower Jordan River, January 13, 2010
TM4	Draft Technical Memo: Critical Conditions, Endpoints, and Permissible Loads in the Jordan River, February 24, 2010
TM5	Draft Technical Memo: Load Allocations for Pollutant Sources Contributing to Impairment of Dissolved Oxygen in the Jordan. Logan, Utah.
TMDL	General comments regarding Jordan River TMDL or process.