

Bear Creek in Missouri
Draft Total Maximum Daily Load (TMDL)
SUMMARY OF COMMENTS AND RESPONSES
Prepared by the Environmental Protection Agency (EPA), Region 7
Water, Wetlands and Pesticides Division
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INTRODUCTION

EPA public noticed a draft TMDL for Bear Creek (water body identification MO_115U-01) from October 7, 2010 to November 15, 2010. EPA is establishing this TMDL to meet the obligations of the 2001 Consent Decree, *American Canoe Association, et al. v. EPA*, Consolidated Case No. 98-482-CV-W, (Consent Decree). This document summarizes and paraphrases comments received, EPA's response to comments and changes made to the final TMDL where appropriate. Included is a list of all commentors.

RESPONSE TO COMMENTS (EPA responses in bold)

1. Comment: The waste load allocations (WLA) for the wastewater treatment facility (WWTF) and municipal separate storm sewer system (MS4) are likely unachievable economically and may be technically impractical if not impossible. The nutrient WLA, e.g., total nitrogen (TN), in the TMDL are beyond the limits of conventional WWTF treatment technology and represent an unachievable target. Tertiary or membrane filtration would be required to meet the biochemical oxygen demand (BOD) and total suspended solids (TSS) reductions. EPA's nutrient removal technology document does not include a case example that consistently meets a TN concentration comparable to the TMDL Table 14 value. Also, conventional urban stormwater best management practices (BMPs) will not achieve the MS4 nutrient WLAs.

1. Response: TMDLs are written to meet current surface WQS (40 CFR § 130.7(c)(1)(ii)). It is the state that incorporates the TMDL into its current water quality management plan for implementation, per EPA regulations (40 CFR § 130.7(c)(1). The Missouri Department of Natural Resources (MDNR) will collaborate with the TMDL's permitted facilities to design implementation in a manner that makes the TMDL's targets more practical and achievable. MDNR will help Bear Creek's communities address the economic and technical challenges of implementing their WLAs, including issues about filtration types and best management practices. Missouri may submit, and EPA may approve, a revised or modified TMDL for this water at any time if new data emerges that would impact the current TMDL.

Missouri has the authority to monitor and access state waters to ensure protection of the designated beneficial uses.

2. Comment: The TMDL and stream model (QUAL2K) used in the TMDL do not establish a quantitative link between sources and the listed cause of impairment. The TMDL qualitatively ties nutrients to the dissolved oxygen (DO) impairment, but no quantitative analysis was used to

demonstrate nutrient WLAs are needed to address or meet a DO concentration of 5.0 milligrams/liter (mg/L). The TMDL should use QUAL2K to perform a sensitivity analysis that demonstrates what reductions in total phosphorus (TP) and TN are necessary to achieve 5.0 mg/L DO.

In another comment: The TMDL load duration curves (LDCs) do not provide a link between nutrients and DO or the aquatic life beneficial use. The TMDL sets nutrient and TSS WLAs for the city's MS4 permit. The water quality limited segment is included on the EPA-approved 2008 Missouri 303(d) List and is identified as impaired due to unknown pollutants and sources, so why is the TMDL linked to TSS and nutrients.

2. Response: EPA believes that the methodology linking the sources and listed cause of impairments as described in Appendix B, C & D of the TMDL is technically defensible. This methodology has been used in developing several TMDLs approved by EPA. The TMDL (and QUAL2K model) cannot calculate percent reductions for TP and TN because the permitted facilities do not have permit limits for these constituents; therefore the sensitivity analysis suggested by the commentor is not needed. For an understanding of how the WLA are needed to meet the 5.0 mg/L DO criterion, please see Section 3 (in the first paragraph) and Sections 8 and 9 of the TMDL.

2a Comment: To quantify the impact of MS4 discharges to DO concentrations in Bear Creek during runoff events, a dynamic model such as WASP or HSPF is needed. The TMDL uses QUAL2K which is a steady-state, low-flow model to predict DO concentrations while MS4 discharges will occur during runoff events, i.e., not low flows.

2a. Response: The QUAL2K water quality model was selected for the development of the Bear Creek DO TMDL because it is used extensively for TMDL development and point source permitting issues across the country, especially for issues related to DO concentrations. The QUAL2K model is suitable for simulating hydraulics and water quality conditions of small rivers and streams. It is a one-dimensional uniform flow model with the assumption of a completely mixed system for each computational cell. QUAL2K assumes that the major pollutant transport mechanisms, advection and dispersion, are significant only along the longitudinal direction of flow. The model allows for multiple waste discharges, water withdrawals, nonpoint source loading, tributary flows and incremental inflows and outflows. The processes employed in QUAL2K addresses nutrient cycles, algal growth, particulate settling, Sediment Oxygen Demand (SOD) and DO dynamics. The QUAL2K model used in the Bear Creek TMDL is to evaluate the effect of a permitted facility on stream DO during a typical flow and/or critical condition. The MS4 discharge is assessed by load duration curve analysis since it does not cause low DO levels, based on the field data. See Appendix B for a detailed explanation of why and how the QUAL2K modeling in Bear Creek is performed.

3. Comment: The TMDL uses a limited demonstration of cause and effect and limited dataset to place "extremely stringent" limits on the city's WWTF and MS4. The resulting uncertainty of the TMDL significantly outweighs the implications of the proposed WLA. Particularly given the technical uncertainties of the MS4 WLAs, these are "unachievable and unwarranted" and EPA is strongly urged to remove the MS4 WLAs from the TMDL.

3. Response: The commentor is concerned because perceived uncertainties in setting the TMDL targets yielded stringent limits that seem unachievable and so the commentor asks EPA to remove WLAs from the TMDL. Regarding the commentor's concerns about uncertainties in the TMDL, Bear Creek's TMDL includes an implicit margin of safety (MOS) which accounts for uncertainties by using conservative assumptions as described in Section 10 of the TMDL. Although the TMDL targets may seem extremely stringent, National Pollutant Discharge Elimination System (NPDES)-regulated storm water discharges must be addressed by the WLA component of a TMDL and cannot be removed from the TMDL. See 40 CFR § 130.2(h). Referring to Response 1 above, MDNR will collaborate with facilities and strive to design implementation in a manner that makes the TMDL targets achievable.

4. Comment: WLAs for TN and TP are not supported by numeric 304(a) water quality (WQ) criteria for flowing waters approved by the Missouri Clean Water Commission or adopted by Missouri. The regulatory basis for the WLAs are unclear.

In a similar comment: For that portion of the stream that is unclassified, only the narrative water quality criteria apply although the TMDL developer chose to use a DO of 5.0 mg/L as the WQS to evaluate the stream.

4. Response: EPA's regulations state that TMDLs can be expressed in several ways, including in terms of toxicity, which is a characteristic of one or more pollutants, or by some "other appropriate measure." 40 CFR § 130.2(i). They also state that TMDLs may be established using a biomonitoring approach as an alternative to the pollutant-by-pollutant approach. 40 CFR § 130.7(c)(1). This flexibility in the expression of TMDLs supports reliance on a surrogate where, as in this case with TN and TP, there is a reasonable rationale and the TMDL is designed to ensure attainment with water quality standards (WQS). Missouri does not have a numeric criterion for TN and TP in freshwater streams; therefore, targets and loading capacities (LCs) are based on EPA-recommended level III Ecoregion 40 (Central Plains/Cuivre/Salt) reference concentrations (EPA, 2000) and water quality observations at locations throughout the ecoregion where Bear Creek is located. Please refer to Section 3.1.1 and Appendix D for a full explanation of how TN and TP have been assigned as the pollutants in this TMDL.

5. Comment: Bear Creek is not identified as being impaired by unacceptably high nutrient concentrations. The TMDL sets nutrient and TSS WLAs for the city's MS4 permit while Bear Creek is listed for unknown.

5. Response: This segment of Bear Creek is currently listed as impaired due to exceedances of Missouri general water quality criteria for protection of aquatic life and natural biological aquatic communities (10 CSR 20-7.031). Historic water quality and aquatic life monitoring in Bear Creek has found unnaturally low diversity of fish species in upstream segments of the Creek according to data from the Missouri Department of Conservation (MDC) as cited in the TMDL Section 2.1. Nutrients and oxygen consuming substances from both point and nonpoint sources are considered to be the most likely potential contributors to the impairment and as such are the focus of the TMDL.

Furthermore, Missouri's general water quality criteria consist of eight narrative criteria that must be met for all water in the state. Bear Creek is included on the EPA approved 2008 Missouri 303(d) List and is identified as impaired due to unknown pollutants and sources. Please see the TMDL's References section to find the Missouri Department of Conservation data on which this TMDL is based.

6. Comment: The data used to calibrate the QUAL2K model should have been at low flow conditions. It appears the July 14, 2009, data used to calibrate the model was influenced by precipitation and runoff, and is the only 2009 sampling event that showed DO less than 5.0 mg/L. It is suspected that runoff from recent rains increased the water temperature above the average of either sampling days in August, by at least two degrees Celsius (C). This reduced the water's oxygen carrying capacity. In addition, there were no notations regarding flow for July 14 and 15, 2009, while the August sampling event noted seven instances of non-detect flows each day upstream and downstream of the Kirksville WWTF. Of the four sampling days in 2009, July 14 is the only one missing weather conditions.

6. Response: July 14 data was not used in model calibration due to the influence of highly variable streamflow observed as a result of precipitation received in the watershed (see page 58 of the TMDL). Since July 14 data was not used in the model, its associated weather data was not included in the modeling document. Flow notations are shown in Table 4. Although there were non-measurable flows at several sites in August, all of the sampling sites had measurable flow values in the two July sampling events (see Tables 4 and 5).

7. Comment: The TMDL discusses the influence of physical factors, i.e., stream morphology, that result in low reaeration rates and low DO concentrations. In fact, several of Missouri's biocriteria streams have instantaneous DO concentrations less than 5.0 mg/L during warm weather, low flow conditions. Given the predicted low reaeration rate in Bear Creek, the concern is that the diel DO profile will not achieve 5.0 mg/L at all times during all seasons with background loads of BOD even if Table 14 values are met. These physical limitations should be evaluated in context of use attainability analyses (UAAs), site specific criteria or a variance to address what may be an unattainable criteria during certain periods and flows.

7. Response: Modification of the designated use, adoption of site specific criteria or possible water body specific variance for Bear Creek are beyond the scope of this specific TMDL public notice. The TMDL is written to address the commentor's concerns about the diel DO as noted in Section 10 of the TMDL where the MOS is discussed. The TMDL is protective of critical conditions and therefore considers seasonal variation (warm weather) and sensitivity of DO (low flow conditions) in the analysis. Please refer to Section 11 of the TMDL for a full discussion.

8. Comment: It appears from the aquatic and habitat data cited in the TMDL that habitat loss could be the reason for impairment rather than excessive nutrients. Sampling site #2 received the lowest stream condition index (SCI) score, yet the TMDL states that the "metric values for macroinvertebrates collected from the rootmat habitat indicate good community health." This is also noted for reach # 1 which is above the treatment plant discharge and is rated as fully supporting aquatic life use while DO does not consistently maintain a level of 5.0 mg/L.

8. Response: Bear Creek's impairment is failing to provide protection of aquatic life and natural biological aquatic communities (10 CSR 20-7.031). Rather than pointing to habitat loss, the data cited presents a strong argument that the decreased aquatic life is from poor water quality. An underlying assumption in interpreting metric values based on the macroinvertebrate community is that a healthy macroinvertebrate community is a reflection of healthy stream conditions. However, the calculated metric values for Bear Creek do not provide clear indications of good versus poor macroinvertebrate community/stream health for a given reach (referred to as both sampling and reach sites in the commenter's question). Indeed reach #6 had the highest SCI scores of all reaches sampled, but was only partially to fully supporting. Bear Creek was placed on the 2002 Missouri 303(d) List of impaired waters because there were reduced numbers of riffle fish species. All EPA data has been analyzed and presented consistent with the procedures included in Appendices A, C, D and E; 40 CFR § 130.2(i) and 40 CFR § 130.7(c)(1).

9. Comment: The use of ecoregional nutrient targets within the TMDL is questionable and particularly unwarranted for stormflow periods represented in the LDCs. The ecoregional nutrient values are typically based upon median or geometric mean values from ambient stream data and as such are expected to be exceeded during stormflow conditions.

9. Response: In the absence of Missouri numeric standards for nutrients in freshwater streams, ambient water quality criteria recommendations provided by the EPA are used to quantify TN and TP LCs in Ecoregion 40 and Bear Creek. Level III Ecoregion 40 targets were used in lieu of national and state-wide targets to ensure either pristine or minimally impacted stream systems. Targets are based on the 25th percentile of all TN and TP data gathered from Subecoregion 40 of Aggregate Nutrient Ecoregion IX. Please refer to the TMDL's Appendix C and Section 4.2 for a more detailed explanation.

10. Comment: Assuming the 2001 data was used for listing, the treatment plant outfall should have been sampled in 2009. While the study does not describe the sampling sites, it appears that sample site #3 is at the treatment plant and reported the most fish species with 11 species found. If sample site #3 is at the treatment plant outfall, it appears the stream provides adequate aquatic habitat.

10. Response: Data was not collected for sampling site #3 because the property owners did not allow the field crew to enter their properties. No fish data was collected during the 2009 field surveys. However, macroinvertebrate and their associated habitat information were gathered in 2009. Based on this study, sampling site #2, located immediately below Kirksville WWTP, had the lowest stream condition index value and habitat score (see Bear Creek Sampling Report and Page 12 in the TMDL Report).

11. Comment: Because Missouri does not have nutrient criteria for flowing streams, MDNR is in the process of revising the DO criteria, a TMDL is not written for the nearest downstream impaired water body with nutrient criteria (Mark Twain Lake) and the stream is partially/fully meeting the beneficial use, it is appropriate to allow the phased implementation of the TMDL. In addition, since the city of Kirksville is planning upgrades to its WWTF, it is appropriate to allow

the city to monitor the stream to see if conditions change before taking such drastic measures as outlined in the TMDL.

11. Response: TMDLs are written to meet current surface WQS (40 CFR § 130.7(c)(1)(ii)). EPA appreciates the commentor's information about future developments that may improve conditions in Bear Creek. Designated beneficial uses and any associated water criteria for each water body are determined by the state and approved by EPA (40 CFR § 131.10(a) and 131.11(a)(1)). One of the hallmarks of the TMDL process is adaptive management or implementation. Adaptive implementation is an iterative process that makes progress toward achieving water quality goals while using any new data and information to reduce uncertainty and adjust implementation activities (40 CFR § 130.7(d)(2)). MDNR will work with permitted facilities identified in the TMDL as per EPA regulations; the state incorporates the TMDL into its current water quality management plan for implementation (40 CFR § 130.7(c)(1)). Missouri has the authority to monitor and access state waters to ensure protection of the designated beneficial uses. Missouri may submit, and EPA may approve, a revised or modified TMDL for this water at any time.

12. Comment: In a report by the Missouri Department of Conservation (MDC), Salt River Watershed Inventory and Assessment Document, it notes the major water quality problem affecting aquatic life and habitat in the Salt River watershed is severe soil erosion from cultivated land and the resulting excessive turbidity and siltation. Further, the report states that point sources have a minor impact on streams compared to nonpoint sources. The TMDL acknowledges the impact of nonpoint sources, but places the full responsibility for initial implementation on the Kirksville WWTF. The enormous amount of money the city would be required to spend would be of little to no benefit to water quality if habitat and nonpoint sources of pollution are not addressed.

12. Response: All sources are considered in the Bear Creek TMDL for all point and nonpoint sources of TSS, TN and TP. Nonpoint sources in the TMDL include loads from agricultural lands, runoff from urban areas, livestock and failing onsite wastewater treatment systems including all existing and future nonpoint sources and natural background contributors (40 CFR § 130.2(g)). The LA also includes runoff from the village of Millard, Missouri. Nonpoint sources are discussed in detail in Section 4.2 of the TMDL and nonpoint loads are found in Tables 11, 12 and 13.

Regarding the commentor's concern about implementation: One of the hallmarks of the TMDL process is adaptive management or implementation. Adaptive implementation is an iterative process that makes progress toward achieving water quality goals while using any new data and information to reduce uncertainty and adjust implementation activities (40 CFR § 130.7(d)(2)). MDNR will work with permitted facilities identified in the TMDL as per EPA regulations; the state incorporates the TMDL into its current water quality management plan for implementation (40 CFR § 130.7(c)(1)). Missouri has the authority to monitor and access state waters to ensure protection of the designated beneficial uses. Missouri may submit and EPA may approve a revised or modified TMDL for this water at any time.

13. Comment: As discussed earlier, the technical issues with the water quality data and modeling with the likely unachievable WLAs justify the use of adaptive management for TMDL implementation. The TMDL should include an adaptive management approach, additional water quality data and modeling efforts to set technically defensible WLA targets and reopener provisions so the LAs and WLAs can be reevaluated in the near future.

13. Response: The TMDL is being written at this time to satisfy the requirements of the Consent Decree. The data used in the draft TMDL were the best available when writing the TMDL. Missouri may submit and EPA may approve a revised or modified TMDL for this water at any time. Should more data be made available, MDNR may then consider submitting a revised or modified TMDL for this water at any time based on the newly obtained data. Please refer to Response 11 above which also addresses future developments in the watershed.

14. Comment: The use of non-linear assimilation capacity relationship rather than the current model that uses linear assimilation capacity relationships is more representative of actual conditions and would allow for higher flow rates to be discharged. This should be considered in the TMDL.

14. Response: The carrying (assimilation) capacity is subject to many modeling settings based on the modeler's best professional judgment. Two models can be selected to depict algal activities; zero and first order. While the former is controlled by nutrients and light, the latter is governed not only by nutrients and light but also space. For Bear Creek, the first order growth model was used and half saturation was chosen for the light model, based on field data collected in 2009. Once the model was calibrated using the July 15 data and validated with the August data, it was then used to simulate dissolved oxygen and nutrient conditions at the design flow of Kirksville WWTP under the critical condition. Based on the model's calibration and validation, the model was well parameterized and adequately described the algal community in the stream. The data used in the draft TMDL were the best available when writing the TMDL. Missouri may submit and EPA may approve a revised or modified TMDL for this water at any time.

15. Comment: The city reserves the right to request EPA to reopen the TMDL and model for future increases in the wastewater plant capacity.

15. Response: Missouri may submit and EPA may approve a revised or modified TMDL for this water at any time. Please refer to Response 11 above which also addresses future developments in the watershed.

LIST OF COMMENTORS

1. John R. Buckwalter, Director, City of Kirksville, Public Works, Kirksville, Missouri.

END SUMMARY OF COMMENTS AND RESPONSES