



## EPA Region 7 TMDL Review

**TMDL ID:** MO\_2864 **State:** MO  
**Document Name:** VILLAGE CREEK  
**Basin(s):** ST. FRANCIS-UPPER ST. FRANCIS RIVER BASIN  
**HUC(s):** 08020202  
**Water body(ies):** VILLAGE CREEK  
**Tributary(ies):** MINE LA MOTTE LAKE, MUSCO CREEK, SHAYS CREEK,  
SWEETWATER CREEK  
**Pollutant(s):** INORGANIC SEDIMENT, LEAD (SEDIMENT)  
**Submittal Date:** 9/16/2009 **Approved:** Yes

### Submittal Letter

*State submittal letter indicates final Total Maximum Daily Load(s) (TMDL) for specific pollutant(s)/water(s) were adopted by the state, and submitted to EPA for approval under section 303(d) of the Clean Water Act [40 CFR § 130.7(c)(1)]. Include date submitted letter was received by EPA, date of receipt of any revisions, and the date of original approval if submittal is a phase II TMDL.*

The TMDL document for Village Creek was formally submitted by the Missouri Department of Natural Resources (MDNR) in a letter received by the United States Environmental Protection Agency (EPA), Region 7, on September 16, 2009. Revisions to the TMDL document were sent by email on 12/07/2009.

### Water Quality Standards Attainment

*The water body's loading capacity (LC) for the applicable pollutant is identified and the rationale for the method used to establish the cause-and-effect relationship between the numeric target and the identified pollutant sources is described. TMDL and associated allocations are set at levels adequate to result in attainment of applicable water quality standards (WQS) [40 CFR § 130.7(c)(1)]. A statement that WQS will be attained is made.*

The TMDL document was written to address the impairment of lead and inorganic sediment on segments 2863 and 2864 of Village Creek, as included on the 2004/2006 Missouri 303(d) list. The inorganic sediment impairment replaces the 1998 303(d) listing impairment sediment and the 2002 303(d) listing impairment non-volatile suspended solids. The LCs are determined by load duration curves addressing the chronic dissolved lead numeric criterion and numeric translators for inorganic sediment, to address the narrative standards.

**Sediment:**

The water quality targets used in the TMDL for inorganic sediment were developed using a reference approach; 1) A total suspended solids (TSS) target was calculated using the 25th percentile of measured concentrations in streams located in the same region of the state, and 2) A percent bedded fine sediment by mass target was set using a control stream located in the adjacent drainage area. The translation of lead and sediment was accomplished by applying an equilibrium partitioning methodology and a bedded sediment relationship between mass of sediment and mass of lead in that sediment with regard to instream lead concentrations. The LC is determined by a load duration curve addressing the lead numeric criterion and numeric translators for inorganic sediment to address the narrative standards.

**Lead:**

Lead follows a defined partitioning behavior between pore water and sediment. The toxicity from lead residues in water occurs in pore water. When lead resides in sediment it exists in equilibrium with pore water. The partitioning behavior can then be predicted. Measured lead in sediment was used to estimate pore water concentrations which are compared to hardness dependent WQS for lead. The Threshold Effect Concentration (TEC) of 35.8 milligrams per kilogram (mg/kg) was set as an additional lead target such that the percent of lead in a given mass of sediment is below the TEC. A strong statistical correlation exists between total and dissolved lead concentrations, suggesting that dissolved lead is a good predictor of total lead concentration in the water column. The chronic WQS for dissolved lead had observed exceedances; no acute criteria exceedances were observed. The TMDL lead endpoint is based on the exceedances of the chronic dissolved lead WQS expressed as a load duration curve using estimated flow values at each outlet.

For segment 2863, the LC at median flow (50 percent flow exceedance), are 0.057 and 109 pounds per day (lbs/day) for dissolved lead and inorganic sediment, respectively. For segment 2864, the LC at median flow (50 percent flow exceedance), are 0.034 and 67.8 lbs/day for dissolved lead and inorganic sediment, respectively. Additional LCs are set for mass per unit mass targets of 136 and 0.0358 mg/kg of fine sediment and lead, respectively. These mass targets apply for both segments. An additional target was set at the TEC of 35.8 mg/kg, for which the mass of lead in a specific mass of sediment show toxicity to aquatic organisms.

WQS should be attained when the listed LCs are achieved.

**Numeric Target(s)**

*Submittal describes applicable WQS, including beneficial uses, applicable numeric and/or narrative criteria. If the TMDL is based on a target other than a numeric water quality criterion, then a numeric expression, site specific if possible, was developed from a narrative criterion and a description of the process used to derive the target is included in the submittal.*

The applicable Missouri WQS for the inorganic sediment TMDLs are:

10 CSR 20-7.031(3)

- (A) Waters shall be free from substances in sufficient amounts to cause the formation of putrescent, unsightly or harmful bottom deposits or prevent full maintenance of beneficial uses;
- (C) Waters shall be free from substances in sufficient amounts to cause unsightly color or turbidity, offensive odor or prevent full maintenance of beneficial uses;
- (D) Waters shall be free from substances or conditions in sufficient amounts to result in toxicity to human, animal or aquatic life;

10 CSR 20-7.031(4)

(H) Solids. Water contaminants shall not cause or contribute to solids in excess of a level that will interfere with beneficial uses. The stream or lake bottom shall be free of materials which will adversely alter the composition of the benthos, interfere with the spawning of fish or development of their eggs or adversely change the physical or chemical nature of the bottom.

The applicable Missouri WQS for the Lead TMDLs are:

10 CSR 20-7.031(4)(A)

The maximum chronic toxicity criteria in Tables A and B shall apply to waters designated for the indicated uses given in Tables G and H. All Table A and B criteria are chronic toxicity criteria, except those specifically identified as acute criteria. Water contaminants shall not cause or contribute to concentrations in excess of these values.

10 CSR 20-7.031(4)(B)1

Water contaminants shall not cause the criteria in Tables A and B to be exceeded. Concentrations of these substances in bottom sediments or waters shall not harm benthic organisms and shall not accumulate through the food chain in harmful concentrations, nor shall state and federal maximum fish tissue levels for fish consumption be exceeded.

The applicable Missouri WQS for hardness are:

Hardness	50-74	75-99	100-124	125-149	150-174	175-199	200-224	225-249	250+
Lead ug/L									
Acute	30	47	65	82	100	118	136	154	172
Chronic	1	2	3	3	4	5	5	6	7

The beneficial uses for both segments of Village Creek are the same: Livestock Watering, Protection of Warmwater Aquatic Life, Protection of Human Health (Fish Consumption), and Whole Body Contact Recreation - Category B.

For segment 2863, the LCs at median flow (50 percent flow exceedance), are 0.057 and 109 lbs/day dissolved lead and inorganic sediment, respectively. For segment 2864, the LC at median flow (50 percent flow exceedance), are 0.034 and 67.8 lbs/day dissolved lead and inorganic sediment, respectively. Additional LCs are set for mass per unit mass targets of 136 and 0.0358 mg/Kg of fine sediment and lead, respectively. An additional target was set at the TEC of 35.8 mg/kg.

### Pollutant(s) of concern

An explanation and analytical basis for expressing the TMDL through surrogate measures (e.g., parameters such as percent fines and turbidity for sediment impairments, or chlorophyll-a and phosphorus loadings for excess algae) is provided, if applicable. For each identified pollutant, the submittal describes analytical basis for conclusions, allocations and margin of safety (MOS) that do not exceed the LC. If submittal is a phase II TMDL there are refined relationships linking the load to WQS attainment. If there is an increase in the TMDL there is a refined relationship specified to validate the increase in TMDL (either load allocation (LA) or waste load allocation (WLA)). This section will compare and validate the change in targeted load between the versions.

The submittal targets an established link between TSS and percent fine bottom sediment to address the narrative impairment of inorganic sediment. The TSS target is calculated from the 25th percentile of all available data located within the ecological drainage unit in which the water body is located. The lead sediment target was set using the percent of lead in a given mass of sediment such that the TEC is below the target level. The inorganic sediment target is also represented by calculating the percent fine sediment by mass. These targets are appropriate, as the region in which the impaired stream segments exist is not typically a source of sediment, either organic or inorganic, to the streams that drain through that area. As an additional MOS a bed sediment target of percent fine sediments is set equal to that of a nearby control stream.

The lead targets were established linking total lead to the dissolved lead criterion from the approved Missouri WQS. An analysis of the relationship of total to dissolved lead concentrations shows a strong statistical correlation and suggests that dissolved lead concentration is a good predictor of total lead concentration in the water column. Measured lead in sediment data were used to calculate pore water concentration based on partitioning coefficients of sediment lead in water. The partitioning coefficient allows a range of concentrations in pore water with a given concentration in sediment to be calculated. This resulted in an additional lead target for the threshold effect concentration of lead in sediment. This is not a numeric criterion in the approved Missouri WQS but serves as an additional target to address narrative criteria protecting benthic invertebrate life.

### Source Analysis

*Important assumptions made in developing the TMDL, such as assumed distribution of land use in the watershed, population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources, are described. Point, nonpoint and background sources of pollutants of concern are described, including magnitude and location of the sources. Submittal demonstrates all significant sources have been considered. If this is a phase II TMDL any new sources or removed sources will be specified and explained.*

This watershed is located within Operable Unit-01 of the Superfund site known as Madison County Mines. The designation occurred in 2003 and is being evaluated.

The submittal states there are no permitted point sources in the watershed of either segment that would serve as a source for either lead or inorganic sediment. The point source for both pollutants is identified as primarily the abandoned Mine La Motte tailings area. The tailings area covers approximately 495 acres and is part of a privately owned recreational area with around 250 acres covered by tailings. This area contains a 100-acre recreational pond as well as a playground, camping sites, and off-road recreational areas.

The submittal recognizes the possibility of nonpoint source loading of lead and inorganic sediment from runoff due to haul and access roads, highways, and parking lots. This runoff may contain automotive sources of lead (e.g., tire residues, exhaust fumes, battery fluid, and motor oil). Urban and impervious land uses occupy 1.8 percent in segment 2863, and 3.8 percent in segment 2864, of the total watershed areas. Undisturbed areas of the watershed are expected to only contribute minor amounts of inorganic sediment and dissolved lead.

There are no state-permitted concentrated animal feeding operations, or CAFOs, in the watershed, the likely presence of lower density livestock populations on grassland pastures may also be a potential contributor of inorganic sediment to Village Creek. Livestock influences are expected to be minor when compared to contributions from the Mine La Motte abandoned mine land tailings pile.

It appears all known sources have been included.

### Allocation - Loading Capacity

*Submittal identifies appropriate WLA for point, and load allocations for nonpoint sources. If no point sources are present the WLA is stated as zero. If no nonpoint sources are present, the LA is stated as zero [40 CFR § 130.2 (i)]. If this is a phase II TMDL the change in LC will be documented in this section.*

The submittal provides LC, WLA, LA, and MOS for each pollutant and each segment covered by this TMDL document. Load duration curves and mass per unit mass targets were used to express the TMDL for dissolved lead and inorganic sediment.

### WLA Comment

*Submittal lists individual WLAs for each identified point source [40 CFR § 130.2(h)]. If a WLA is not assigned it*

*must be shown that the discharge does not cause or contribute to WQS excursions, the source is contained in a general permit addressed by the TMDL, or extenuating circumstances exist which prevent assignment of individual WLAs. Any such exceptions must be explained to a satisfactory degree. If a WLA of zero is assigned to any facility it must be stated as such [40 CFR § 130.2(i)]. If this is a phase II TMDL any differences in phase I and phase II WLAs will be documented in this section.*

At median flow (50 percent flow exceedance), the WLA is equal to 0.034 and 0.057 lbs/day of dissolved lead for segments 2864 and 2863, respectively.

At median flow (50 percent flow exceedance), the WLA is equal to 61 and 98.1 lbs/day of suspended sediment for segments 2864 and 2863, respectively.

A calculated WLA does not authorize a discharge from an unpermitted point source. However, WLAs may be used to improve water quality during future remedial actions, and be incorporated into appropriate enforceable documents (e.g., National Pollutant Discharge Elimination System permits, Applicable Relevant and Appropriate Requirements, storm water permits, etc.).

### **LA Comment**

*Includes all nonpoint sources loads, natural background, and potential for future growth. If no nonpoint sources are identified the LA must be given as zero [40 CFR § 130.2(g)]. If this is a phase II TMDL any differences in phase I and phase II LAs will be documented in this section.*

Because there are negligible and minor nonpoint source loading, LAs of zero are set for both dissolved lead and inorganic sediment (0 lbs/day dissolved lead and 0 lbs/day inorganic sediment), for both segments.

### **Margin of Safety**

*Submittal describes explicit and/or implicit MOS for each pollutant [40 CFR § 130.7(c)(1)]. If the MOS is implicit, the conservative assumptions in the analysis for the MOS are described. If the MOS is explicit, the loadings set aside for the MOS are identified and a rationale for selecting the value for the MOS is provided. If this is a phase II TMDL any differences in MOS will be documented in this section.*

The MOS for lead is implicit. The chronic lead criterion is applied to the pore water as well as the water column, in addition, the threshold effect concentration is also set as a target. The conservative assumptions and factors used in this method should account for any uncertainties in the loading calculations.

The MOS for inorganic sediment is both implicit and explicit. The conservative assumptions and factors used when developing the percent fines target, using a control stream in addition to the reference 25th percentile of TSS concentrations in the region, provides an implicit MOS. Additionally, the submittal provides a 10 percent explicit MOS to account for any uncertainties in the setting of numeric targets to address a narrative standard. At median flow (50 percent flow exceedance), this 10 percent MOS is equal to 6.8 and 10.9 lbs/day of inorganic sediment for segments 2864 and 2863, respectively.

### **Seasonal Variation and Critical Conditions**

*Submittal describes the method for accounting for seasonal variation and critical conditions in the TMDL(s) [40 CFR § 130.7(c)(1)]. Critical conditions are factors such as flow or temperature which may lead to the excursion of WQS. If this is a phase II TMDL any differences in conditions will be documented in this section.*

The load duration curve represents the maximum one-day load the water body can assimilate and maintain the water quality criterion, while the given mass of lead per mass of sediment is instantaneous and applies on any day in which the content in bed sediment is measured. The use of mass per unit mass and load duration curves apply during all times and account for seasonal and flow variations.

The use of pore water target concentrations addresses the critical condition and protects the benthic invertebrate aquatic life living in close contact with pore water. This target addresses conditions of low flow when water column concentrations of lead are likely to be higher due to less dilution of pore water loading into the water column.

## **Public Participation**

*Submittal describes required public notice and public comment opportunity, and explains how the public comments were considered in the final TMDL(s) [40 CFR § 130.7(c)(1)(ii)].*

This document was placed on public notice and posted on the MDNR website from July 27, 2009 and comments were accepted through August 26, 2009. MDNR received three comments on the draft TMDL document. The comments and MDNR's response letters are included in the submission of the TMDL document.

## **Monitoring Plan for TMDL(s) Under Phased Approach**

*The TMDL identifies a monitoring plan that describes the additional data to be collected to determine if the load reductions required by the TMDL lead to attainment of WQS, and a schedule for considering revisions to the TMDL(s) (where phased approach is used) [40 CFR § 130.7].*

Monitoring was completed in May 2008. MDNR will review data collected through the Missouri Department of Conservation's Resource Assessment and Monitoring program which samples physical and biological components of randomly selected streams on a five to six year rotating schedule.

## **Reasonable Assurance**

*Reasonable assurance only applies when less stringent WLAs are assigned based on the assumption of nonpoint source reductions in the LA will be met [40 CFR § 130.2(i)]. This section can also contain statements made by the state concerning the state's authority to control pollutant loads.*

Increased reductions in nonpoint source loads are not being required in lieu of less stringent WLAs so reasonable assurances are not required. The LA is set at zero.