UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VII
901 NORTH 5TH STREET
KANSAS CITY, KANSAS 66101

12 FEB 2004

Jim Hull, Director
Water Pollution Control Program
Water Protection and Soil Conservation Division
Missouri Department of Natural Resources
P.O. Box 176
Jefferson City, MO 65102

Dear Mr. Hull:

Re: Approval of TMDLs for Middle Fork Tebo Creek, Trib. Middle Fork Tebo Cr.,West Fork Tebo Creek, and Trib. Barker Creek

This letter responds to the two submissions from Missouri received by EPA on December 12, 2003 and December 31, 2003, for ten (six Water Quality Limited (WQL) and four non-Water Quality Limited (non-WQL)) Total Maximum Daily Loads (TMDLs), and one "TMDL-not-needed", for impairments identified on the 1998 and the 2002 Missouri §303(d) lists. These submissions fulfill the Clean Water Act statutory requirement to develop TMDLs for those impairments listed on a state's §303(d) list. The specific impairments (water body segments and pollutants) are:

Water Body Name	WBID	Listed pollutant	TMDL pollutant
East Fork Tebo Creek	1282	pH	pH (TMDL-not-needed)
Middle Fork Tebo Creek	1284	sulfate	sulfate(WQL)
Middle Fork Tebo Creek	1284	-	chloride (non-WQL)
Trib. Middle Fork Tebo Cr.	1288	pH	pH(WQL)
Trib. Middle Fork Tebo Cr.	1288	sulfate	sulfate(WQL)
Trib. Middle Fork Tebo Cr.	1288	-	chloride(non-WQL)
West Fork Tebo Creek	1292	sulfate	sulfate(WQL)
West Fork Tebo Creek	1292	-	chloride(non-WQL)
Trib. Barker Creek	1211	pH	pH(WQL)
Trib. Barker Creek	1211	sulfate	sulfate(WQL)
Trib. Barker Creek	1211	-	chloride(non-WQL)

where "WQL" means that the TMDL is established for an impairment appearing on the 1998 and/or 2002 Missouri §303(d) lists, and "non-WQL"means that the TMDL is established for a segment-pollutant that does not appear on the 1998 or 2002 Missouri §303(d) list. EPA reviews and approves/disapproves TMDLs only for impairments that appear on the §303(d) list. The

sulfate impairment in Trib. to Barker Creek appears only on the 2002 §303(d) list. All the other five impairments appear on both the 1998 and the 2002 §303(d) lists. The WBIDs, above, are those that appear in the 1998 Missouri §303(d) list.

EPA has completed its review of the six WQL TMDLs with supporting documentation and information. By this letter EPA approves the six WQL TMDLs submitted. Enclosed with this letter are Region 7 TMDL Decision Documents which summarize the rationale for EPA's approval of each of these six TMDLs. The EPA believes the separate elements of the TMDLs described in the enclosed forms adequately address the pollutants of concern, taking into consideration seasonal variation and a margin of safety.

EPA acknowledges Missouri's effort to establish four TMDLs for segment-pollutants that do not appear in the 1998 or 2002 Missouri §303(d) list, also known as §303(d)(3) TMDLs. EPA is not required to review and approve/disapprove these four TMDLs. EPA understands that Missouri established these four TMDLs because the Missouri WQS are for "sulfate plus chloride" rather than sulfate and chloride separately, and therefore chloride levels must be considered along with sulfate to attain WQS, even though only sulfate appears on the §303(d) list.

The submittal letter dated December 12, 2003 contains water quality information for pH in East Fork Tebo Creek, and Missouri claims that this water body now attains water quality standards. EPA agrees that the evidence provided shows that the pH WQS is now attained. EPA expects future Section 303(d) lists and supporting documentation from Missouri to account for this segment-pollutant.

EPA is currently engaged in consultation under Section 7 of the Endangered Species Act with the U.S. Fish and Wildlife Service regarding these TMDLs. While EPA is approving these six WQL TMDLs at the present time, EPA may decide that changes to the TMDLs are warranted based upon the results of the consultation when it is completed.

EPA appreciates the thoughtful effort that Missouri has put into these TMDLs, and will continue to cooperate with and assist, as appropriate, in future efforts by Missouri to develop the remaining TMDLs.

Sincerely,

Leo J. Alderman
Director
Water, Wetlands, and Pesticides Division

Enclosures

cc: Sharon Clifford, TMDL Coordinator, Water Pollution Control Program, Jefferson City, MO

EPA Region 7 TMDL Review

TMDL ID	291	*Water Body ID*	1284
Water Body Name	Middle Fork Tebo Creek		
Pollutant	sulfate		
Tributary			
State	MO *HUC*	10290108	
Basin	Osage River		
Submittal Date	12/12/2003		
Approved	yes		

Submittal Letter

State submittal letter indicates final TMDL(s) 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.

Submittal letter received on December 12, 2003.

Water Quality Standards Attainment

The water body's loading capacity 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.

The WQS for sulfate in this TMDL is derived from a combined sulfate plus chloride numeric criterion of 1000 mg/L. This water body is listed only for sulfate. This TMDL establishes allocations for the combined criterion, so that bundled with this sulfate TMDL is implicitly a Section 303(d)(3) TMDL for chloride. By establishing an allocation for the combined criterion, the level of sulfate will be adequate to attain the numeric water quality criterion.

Numeric Target(s)

Submittal describes applicable water quality standards, 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 target is based on the numeric water quality criterion. In this case, the numeric criterion is for sulfate plus chloride. The chloride levels are not influenced by loadings received from the abandoned coal mine lands. Thus, this TMDL establishes loadings for sulfate, which comes from the abandoned coal mine lands.

Link Between Numeric Target(s) and 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 that do not exceed the load capacity.

The link between the numeric target and the sulfate pollutant is direct, and expressed in concentration units.

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, non point and background sources of pollutants of concern are described, including magnitude and location of the sources. Submittal demonstrates all significant sources have been considered.

The source of excessive sulfate is water from abandoned coal mine lands. There are no point sources and background levels of sulfate are insignificant. All significant sources of sulfate have been considered.

Allocation

Submittal identifies appropriate wasteload allocations for point, and load allocations for nonpoint sources. If no point sources are present the wasteload allocation is zero. If no nonpoint sources are present, the load allocation is zero.

The allocations are in units of concentration, and can not be summed as LA + WLA + MOS = TMDL. The allocations are established for the sum of two substances, sulfate plus chloride, which agrees with the Missouri standards.

WLA Comment

The WLA for sulfate is established as zero.

LA Comment

The LA for sulfate is established as 970 mg/L of sulfate plus chloride.

Margin of Safety

Submittal describes explicit and/or implicit margin of safety for each pollutant. 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.

The margin of safety is explicit, and selected as 3% of the loading capacity. The chloride levels were considered in this margin of safety. The margin of safety was based on the precision of the measurements of chloride and sulfate.

Seasonal Variation and Critical Conditions

Submittal describes the method for accounting for seasonal variation and critical conditions in the TMDL(s).

The allocations are for all seasons, because the processes that cause the excessive levels of sulfate are not significantly affected by the seasons.

Public Participation

Submital describes public notice and public comment opportunity, and explains how the public comments were considered in the final TMDL(s).

Draft copy of report was placed on public notice from October 24, 2003, to November 23, 2003. Public comments were received and approriate adjustments/edits were made in the final report. Six public meetings allowed input from the public, held between August 18 and September 22, 1999. No comments regarding this TMDL were received during the public meetings. This TMDL was described to the Henry County Soil Conservation District Board on April 7, 2002.

Monitoring Plan for TMDL(s) Under Phased Approach

The TMDL identifies the 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).

Since this is a phased TMDL, MDNR will continue to monitor this stream. In 2006, improvement trends will be determined from the monitoring data.

Reasonable assurance

Reasonable assurance only applies when reduction in nonpoint source loading is required to meet the prescribed waste load allocations.

Not required.

EPA Region 7 TMDL Review

TMDL ID	288	*Water Body ID*	1288
Water Body Name	Tributary to. Middle Fork Tebo Creek		
Pollutant	pH		
Tributary			
State	MO	*HUC*	10290108
Basin	Osage River		
Submittal Date	12/12/2003		
Approved	yes		

Submittal Letter

State submittal letter indicates final TMDL(s) 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.

Submittal letter received on December 12, 2003.

Water Quality Standards Attainment

The water body's loading capacity 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.

MO WQS 10 CSR20-7.031 Section (4)(E) says water contaminants shall not cause pH to be outside of the range of 6.5-9.0 standard units. Beneficial usage of the creek are livestock and wildlife watering along with protection of warm water aquatic life and human health associated with fish consumption. Allocations are set for pH and alkalinity. The pH allocation attains the applicable water quality standards, however, since pH is not conservative, alkalinity is also allocated to assure attainment of applicable water quality standards.

Numeric Target(s)

Submittal describes applicable water quality standards, 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.

pH water quality numeric criterion will be met and maintained. The secondary numeric target is net alkalinity (which is approximated by alkalinity) to prevent pH excursions outside the pH criterion caused by latent acidity. Net alkalinity is a conservative quantity (a conservative quantity does not change as the water flows downstream), whereas pH and alkalinity are not conservative quantities. Lack of data for net alkalinity makes it necessary to use alkalinity as the secondary numeric target. When the magnitude of alkalinity is large, alkalinity and net alkalinity are approximately equal, and alkalinity is a good approximation for net alkalinity.

Link Between Numeric Target(s) and 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 that do not exceed the load capacity.

pH criterion may not provide enough assurance that the proper pH range will be maintained due to possible latent acidity. Net alkalinity would be the preferred secondary water quality target, but the lack of sufficient acidity data makes this analysis difficult. Because of this, total alkalinity will be used as the secondary numeric water quality target. Alkalinity can be measured in Trib. Middle Fork Tebo Creek and can be linked by correlation analysis to the pH numeric criterion using instream monitoring data. The secondary numeric alkalinity target assures that the load capacity for acidity (low pH) is not exceeded.

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, non point and background sources of pollutants of concern are described, including magnitude and location of the sources. Submittal demonstrates all significant sources have been considered.

The major contribution to pH is acid mine drainage which is a result of the oxidation of sulfide minerals in rocks in coal mining waste sites. The TMDL discusses all significant sources of acidity (low pH).

Allocation

Submittal identifies appropriate wasteload allocations for point, and load allocations for nonpoint sources. If no point sources are present the wasteload allocation is zero. If no nonpoint sources are present, the load allocation is zero.

The water body will have to meet in-stream water quality standards for pH (6.5-9.0 SU) and an alkalinity of 35 mg/L calcium carbonate or more. Neither the pH nor the alkalinity

concentrations used as the numeric TMDL endpoints can be summed as LAs + WLAs + MOS.

WLA Comment

There are no point source dischargers therefore the WLA is zero (expressed as mass of acid). Zero additional acid is equivalent to no induced change in pH.

LA Comment

Load capacity is concentration based; flows entering Trib. Middle Fork Tebo Creek will be required to meet both the pH numeric criteria of 6.5 - 9.0 SU and the secondary target of 35 mg/L calcium carbonate. These allocations are concentrations, and meeting these concentrations restrictions, the numeric water quality criterion, pH (a measure of acid concentration), will be achieved.

Margin of Safety

Submittal describes explicit and/or implicit margin of safety for each pollutant. 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.

The MOS is explicit and applied to the alkalinity numeric target. The regression of instream data for pH and alkalinity provides a "load capacity" of alkalinity of 1.3 mg/L calcium carbonate. The MOS was established at the 95% confidence level of the regression, which was 33.7 mg/L alkalinity (as calcium carbonate).

Seasonal Variation and Critical Conditions

Submittal describes the method for accounting for seasonal variation and critical conditions in the TMDL(s).

No seasonal variation; the primary processes involved in the formation of acid water and the oxidation of sulfide are not significantly impacted by differences in air and water temperatures associated with seasonal change.

Public Participation

Submital describes public notice and public comment opportunity, and explains how the public comments were considered in the final TMDL(s).

Draft copy of report was placed on public notic from October 24, 2003, to November 23, 2003. Public comments were received and approriate adjustments/edits were made in the final report. Six public meetings allowed input from the public, held between August 18 and September 22, 1999. No comments regarding this TMDL were received during the public meetings. This TMDL was described to the Henry County Soil Conservation District Board on April 7, 2002.

Monitoring Plan for TMDL(s) Under Phased Approach

The TMDL identifies the 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).

Since this is a phased TMDL, MDNR will continue to monitor this stream. Improvement trends will be examined in 2006 using the monitoring data.

Reasonable assurance

Reasonable assurance only applies when reduction in nonpoint source loading is required to meet the prescribed waste load allocations.

Not required.

EPA Region 7 TMDL Review

TMDL ID	292	*Water Body ID*	1288
Water Body Name	Tributary to Middle Fork Tebo Creek		
Pollutant	sulfate		
Tributary			
State	MO	*HUC*	10290108
Basin	Osage River		
Submittal Date	12/12/2003		
Approved	yes		

Submittal Letter

State submittal letter indicates final TMDL(s) 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.

Submittal letter received on December 12, 2003.

Water Quality Standards Attainment

The water body's loading capacity 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.

The WQS for sulfate in this TMDL is derived from a combined sulfate plus chloride numeric criterion of 1000 mg/L. This water body is not listed for chloride. This TMDL establishes allocations for the combined criterion, so that bundled with this sulfate TMDL is implicitly a Section 303(d)(3) TMDL for chloride. By establishing an allocation for the combined criterion, the level of sulfate will be adequate to attain the numeric water quality criterion.

Numeric Target(s)

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The target is based on the numeric water quality criterion. In this case, the numeric criterion is for sulfate plus chloride. The chloride levels are not influenced by loadings received from the abandoned coal mine lands. Thus, this TMDL establishes loadings for sulfate, which comes from the abandoned coal mine lands.

Link Between Numeric Target(s) and 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 that do not exceed the load capacity.

The link between the numeric target and the sulfate pollutant is direct, and expressed in concentration units.

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, non point and background sources of pollutants of concern are described, including magnitude and location of the sources. Submittal demonstrates all significant sources have been considered.

The source of excessive sulfate is water from abandoned coal mine lands. There are no point sources and background levels of sulfate are insignificant. All significant sources of sulfate have been considered.

Allocation

Submittal identifies appropriate wasteload allocations for point, and load allocations for nonpoint sources. If no point sources are present the wasteload allocation is zero. If no nonpoint sources are present, the load allocation is zero.

The allocations are in units of concentration, and can not be summed as LA + WLA + MOS = TMDL. The allocations are established for the sum of two substances, sulfate plus chloride, which agrees with the Missouri standards.

WLA Comment

The WLA for sulfate is established as zero.

LA Comment

The LA for sulfate is established as 970 mg/L of sulfate plus chloride.

Margin of Safety

Submittal describes explicit and/or implicit margin of safety for each pollutant. 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.

The margin of safety is explicit, and selected as 3% of the loading capacity. The chloride levels were considered in this margin of safety. The margin of safety was based on the precision of the measurements of chloride and sulfate.

Seasonal Variation and Critical Conditions

Submittal describes the method for accounting for seasonal variation and critical conditions in the TMDL(s).

The allocations are for all seasons, because the processes that cause the excessive levels of sulfate are not significantly affected by the seasons.

Public Participation

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Monitoring Plan for TMDL(s) Under Phased Approach

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Since this is a phased TMDL, MDNR will continue to monitor this stream. The data will be examined in 2006 for improvement trends.

Reasonable assurance

Reasonable assurance only applies when reduction in nonpoint source loading is required to meet the prescribed waste load allocations.

Not required.

EPA Region 7 TMDL Review

TMDL ID	293	*Water Body ID*	1292
Water Body Name	West Fork Tebo Creek		
Pollutant	sulfate		
Tributary			
State	MO	*HUC*	10290108
Basin	Osage River		
Submittal Date	12/12/2003		
Approved	yes		

Submittal Letter

State submittal letter indicates final TMDL(s) 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.

Submittal letter received on December 12, 2003.

Water Quality Standards Attainment

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The WQS for sulfate in this TMDL is derived from a combined sulfate plus chloride numeric criterion of 1000 mg/L. This water body is listed only for sulfate. This TMDL establishes allocations for the combined criterion, so that bundled with this sulfate TMDL is implicitly a Section 303(d)(3) TMDL for chloride. By establishing an allocation for the combined criterion, the level of sulfate will be adequate to attain the numeric water quality criterion.

Numeric Target(s)

Submittal describes applicable water quality standards, 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 target is based on the numeric water quality criterion. In this case, the numeric criterion is for sulfate plus chloride. The chloride levels are not influenced by loadings received from the abandoned coal mine lands. Thus, this TMDL establishes loadings for sulfate, which comes from the abandoned coal mine lands.

Link Between Numeric Target(s) and Pollutant(s) of concern

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Source Analysis

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The source of excessive sulfate is water from abandoned coal mine lands. There are no point sources and background levels of sulfate are insignificant. All significant sources of sulfate have been considered.

Allocation

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The allocations are in units of concentration, and can not be summed as LA + WLA + MOS = TMDL. The allocations are established for the sum of two substances, sulfate plus chloride, which agrees with the Missouri standards.

WLA Comment

The WLA for sulfate is established as zero.

LA Comment

The LA for sulfate is established as 970 mg/L of sulfate plus chloride.

Margin of Safety

Submittal describes explicit and/or implicit margin of safety for each pollutant. 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.

The margin of safety is explicit, and selected as 3% of the loading capacity. The chloride levels were considered in this margin of safety. The margin of safety was based on the precision of the measurements of chloride and sulfate.

Seasonal Variation and Critical Conditions

Submittal describes the method for accounting for seasonal variation and critical conditions in the TMDL(s).

The allocations are for all seasons, because the processes that cause the excessive levels of sulfate are not significantly affected by the seasons.

Public Participation

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Monitoring Plan for TMDL(s) Under Phased Approach

The TMDL identifies the 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).

Since this is a phased TMDL, MDNR will continue to monitor this stream. Monitoring data will be used in 2006 to assess improvement trends.

Reasonable assurance

Reasonable assurance only applies when reduction in nonpoint source loading is required to meet the prescribed waste load allocations.

Not required.

EPA Region 7 TMDL Review

TMDL ID	289	*Water Body ID*	9000 (TMDL), 1211 (listed)
Water Body Name	Tributary to Barker Creek		
Pollutant	pH		
Tributary			
State	MO	*HUC*	10290108
Basin	Osage River		
Submittal Date	12/31/2003		
Approved	yes		

Submittal Letter

State submittal letter indicates final TMDL(s) 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.

Submittal letter received on December 31, 2003, revision received January 21, 2004.

Water Quality Standards Attainment

The water body's loading capacity 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.

MO WQS 10 CSR20-7.031 Section (4)(E) says water contaminants shall not cause pH to be outside of the range of 6.5-9.0 standard units. Beneficial usage of the creek are livestock and wildlife watering along with protection of warm water aquatic life and human health associated with fish consumption.Allocations are set for pH and alkalinity. The pH allocation attains the applicable water quality standards, however, since pH is not conservative, alkalinity is also allocated to assure attainment of applicable water quality standards.

Numeric Target(s)

Submittal describes applicable water quality standards, 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.

pH water quality numeric criterion will be met and maintained. The secondary numeric target is net alkalinity (which is approximated by alkalinity) to prevent pH excursions outside the pH criterion caused by latent acidity. Net alkalinity is a conservative quantity (a conservative quantity does not change as the water flows downstream), whereas pH and alkalinity are not conservative quantities. Lack of data for net alkalinity makes it necessary to use alkalinity as the secondary numeric target. When the magnitude of alkalinity is large, alkalinity and net alkalinity are approximately equal, and alkalinity is a good approximation for net alkalinity.

Link Between Numeric Target(s) and 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 that do not exceed the load capacity.

pH criterion may not provide enough assurance that the proper pH range will be maintained due to possible latent acidity. Net alkalinity would be the preferred secondary water quality target, but the lack of sufficient acidity data makes this analysis difficult. Because of this, total alkalinity will be used as the secondary numeric water quality target. Alkalinity can be measured in Trib. Barker Creek and can be linked by correlation analysis to the pH numeric criterion using instream monitoring data. The secondary alkalinity numeric target assures that the load capacity for acidity (low pH) is not exceeded.

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, non point and background sources of pollutants of concern are described, including magnitude and location of the sources. Submittal demonstrates all significant sources have been considered.

The major contribution to pH is acid mine drainage which is a result of the oxidation of sulfide minerals in rocks in coal mining waste sites. The TMDL discusses all significant sources of acidity (low pH).

Allocation

Submittal identifies appropriate wasteload allocations for point, and load allocations for nonpoint sources. If no point sources are present the wasteload allocation is zero. If no nonpoint sources are present, the load allocation is zero.

The water body will have to meet in-stream water quality standards for pH (6.5-9.0 SU) and an alkalinity of 35 mg/L calcium carbonate or more. Neither the pH nor the alkalinity concentrations used as the numeric TMDL endpoints can be summed as LAs + WLAs +

MOS.

WLA Comment

There are no point source dischargers therefore the WLA is zero (expressed as mass of acid). Zero additional acid is equivalent to no induced change in pH.

LA Comment

Load capacity is concentration based; flows entering Trib. Barker Creek will be required to meet both the pH numeric criteria of 6.5 - 9.0 SU and the secondary target of 35 mg/L calcium carbonate. These allocations are concentrations, and meeting these concentrations restrictions, the numeric water quality criterion, pH (a measure of acid concentration), will be achieved.

Margin of Safety

Submittal describes explicit and/or implicit margin of safety for each pollutant. 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.

The MOS is explicit and applied to the alkalinity numeric target. The regression of instream data for pH and alkalinity provides a "load capacity" of alkalinity of 22.7 mg/L calcium carbonate. The MOS was established at the 95% confidence level of the regression, which was 12.7 mg/L alkalinity (as calcium carbonate).

Seasonal Variation and Critical Conditions

Submittal describes the method for accounting for seasonal variation and critical conditions in the TMDL(s).

No seasonal variation; the primary processes involved in the formation of acid water and the oxidation of sulfide are not significantly impacted by differences in air and water temperatures associated with seasonal change.

Public Participation

Submital describes public notice and public comment opportunity, and explains how the public comments were considered in the final TMDL(s).

Draft copy of report was placed on public notic from November 21, 2003, to December 21, 2003. Public comments were received and approriate adjustments/edits were made in the final report. Six public meetings allowed input from the public, held between August 18 and September 22, 1999. No comments regarding this TMDL were received during the public meetings. This TMDL was described to the Henry County Soil Conservation District Board on April 7, 2002.

Monitoring Plan for TMDL(s) Under Phased Approach

The TMDL identifies the 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).

Since this is a phased TMDL, MDNR will continue to monitor this stream twice annually. A survey to assess macroinvertebrate diversity is planned.

Reasonable assurance

Reasonable assurance only applies when reduction in nonpoint source loading is required to meet the prescribed waste load allocations.

Not required.

EPA Region 7 TMDL Review

TMDL ID	290	*Water Body ID*	1211 (listed), 9000(TMDL)
Water Body Name	Tributary to Barker Creek		
Pollutant	sulfate		
Tributary			
State	MO	*HUC*	10290108
Basin	Osage River		
Submittal Date	12/31/2003		
Approved	yes		

Submittal Letter

State submittal letter indicates final TMDL(s) 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.

Submittal letter received on December 31, 2003, revision received January 21, 2004.

Water Quality Standards Attainment

The water body's loading capacity 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.

The WQS for sulfate in this TMDL is part of a combined sulfate plus choride numeric criterion of 1000 mg/L. This water body is listed only for sulfate. This TMDL establishes allocations for the combined criterion, so that bundled with this sulfate TMDL is implicitly a Section 303(d)(3) TMDL for chloride. By establishing an allocation for the combined criterion, the level of sulfate will be adequate to attain the numeric water quality criterion.

Numeric Target(s)

Submittal describes applicable water quality standards, 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 target is based on the numeric water quality criterion. In this case, the numeric criterion is for sulfate plus chloride concentration. The chloride levels are not influenced by loadings received from the abandoned coal mine lands. Thus, this TMDL establishes loadings for sulfate, which comes from the abandoned coal mine lands.

Link Between Numeric Target(s) and 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 that do not exceed the load capacity.

The link between the numeric target and the sulfate pollutant is direct, and expressed in concentration units.

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, non point and background sources of pollutants of concern are described, including magnitude and location of the sources. Submittal demonstrates all significant sources have been considered.

The source of excessive sulfate is water from abandoned coal mine lands. There are no point sources and background levels of sulfate are insignificant. All significant sources of sulfate have been considered.

Allocation

Submittal identifies appropriate wasteload allocations for point, and load allocations for nonpoint sources. If no point sources are present the wasteload allocation is zero. If no nonpoint sources are present, the load allocation is zero.

The allocations are in units of concentration, and can not be summed as LA + WLA + MOS = TMDL. The allocations are established for the sum of two substances, sulfate plus chloride, as given in the Missouri WQ standards.

WLA Comment

The WLA for sulfate is established as zero.

LA Comment

The LA for sulfate is established as 970 mg/L of sulfate plus chloride.

Margin of Safety

Submittal describes explicit and/or implicit margin of safety for each pollutant. 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.

The margin of safety is explicit, and selected as 3% of the loading capacity. The chloride levels were considered in this margin of safety. The margin of safety was based on the precision of the measurements of chloride and sulfate.

Seasonal Variation and Critical Conditions

Submittal describes the method for accounting for seasonal variation and critical conditions in the TMDL(s).

The allocations are for all seasons, because the processes that cause the excessive levels of sulfate are not significantly affected by the seasons.

Public Participation

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Reasonable assurance

Reasonable assurance only applies when reduction in nonpoint source loading is required to meet the prescribed waste load allocations.

Not required.
