



EPA Region 7 TMDL Review

TMDL ID:MO_0557

State: MO

Document Name: MUDDY CREEK

Basin(s): GRAND-THOMPSON RIVER BASIN

HUC(s): 10280102

Water body(ies): MUDDY CREEK

Tributary(ies): IRWIN CREEK, LITTLE MUDDY CREEK

Pollutant(s): TOTAL NITROGEN, TOTAL PHOSPHORUS, TOTAL SUSPENDED SOLIDS, UNKNOWN

Submittal Date:9/2/2010

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.

This TMDL document was formally submitted by the Missouri Department of Natural Resources (MDNR). The United States Environmental Protection Agency (EPA) received this document by mail on September 2, 2010. Revisions to this document were received by email on October 6 and October 13, 2010.

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.

While Muddy Creek TMDL was listed on the 2008 Missouri § 303(d) List as impaired by unknown pollutants, the TMDL is written to address impairment by nutrient enrichment and sedimentation. Water quality monitoring has not revealed violation of a specific numeric WQS; however, total suspended solids (TSS), total nitrogen (TN) and total phosphorus (TP) have been identified as potential contributors to the impairment. The number one pollutant entering Missouri waters is sediment. In addition, other pollutants like nitrogen, phosphorus, pathogens and heavy metals are often attached to soil particles and carried into streams with the sediment. A reduction in TSS, TN and TP are required as these pollutants are impairing the General Narrative Criteria pertaining to the protection of aquatic life for the entire length of Muddy Creek segment 557 as listed in Missouri's 2008 § 303(d) List. TMDLs should have a quantifiable endpoint to measure whether or not the applicable WQS are attained and the associated use(s) protected (40 CFR § 130.7(c)(1) "TMDLs shall be established at levels necessary to attain and maintain" WQS). If the endpoint is not based on an ambient numeric criterion, then it can be developed from narrative criteria. *See, e.g., 40 CFR § 122.44(d)(1)(vi).*

Muddy Creek was originally placed on the 2002 § 303(d) List based on observed impairments noted during a visual/benthic low-flow survey conducted in 2000. Visual stream surveys were conducted at three sites and the study concluded that, compared to other streams in the area, overall biological diversity in Muddy Creek appeared to be reduced. The report noted in particular that:

- Muddy Creek is heavily channelized, which may contribute to a loss of aquatic habitat.
- Rocks appeared to be darkened by manganese, possibly indicating periods of low dissolved oxygen (DO).
- The water was slightly green and prostrate and filamentous algae were more prominent than in other nearby

streams, possibly indicating increased nutrients.

To address nutrient levels, both TN and TP are selected because both nutrients are generally elevated by point and nonpoint sources. The EPA nutrient Ecoregion (where Muddy Creek is located) Level III 40, Central Irregular Plains reference concentrations were used. The reference concentration for TN is 0.855 milligrams per liter (mg/L) and the reference concentration for TP is 0.092 mg/L. The TMDL uses a method to target specific concentrations at differing flows which will result in an annual average equal to the ecoregion target. As such, the ecoregion concentration will not be the target at all flows. These differing concentrations are calculated based on the range of current concentrations and a ratio adjustment such that the ecoregion targets are met.

There are many quantitative indicators of organic sediment, such as TSS, turbidity and bedload sediment, which are appropriate to describe sediment in rivers and streams. TSS was selected as one of the numeric targets for this TMDL because it enables the use of the highest quality data available, including permit and monitoring data. Since fine particle sized sediment and suspended particles of organic matter are derived from similar loading conditions of terrestrial and stream bank erosion, this TMDL will have TSS as one of its allocations to address both. This target was derived based on a reference approach by targeting the 25th percentile base load concentration (5.75 mg/L) of all available TSS measurements in the geographic region in which Muddy Creek is located.

The targets for TSS, TN and TP were based on load duration curves (LDCs), which determine the TMDL for each of these parameters at every flow probability. These reductions in nutrients and sediment protects the warm water aquatic life use of the stream and the TMDLs should result in WQS attainment. The LC for TN and TP is defined by a load duration curve (LDC) set at the ecoregion reference concentrations. The LC for TSS is defined by a LDC set at the 25th percentile of TSS measurements available in the ecological drainage unit (EDU). The LCs for TN, TP and TSS at the 50 percent flow exceedance (for the Missouri portion of the watershed only) are 86.03 lbs/day, 9.77 lbs/day and 1,234.48 lbs/day, respectively.

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.

Because Muddy Creek is impaired by unknown pollutants, specific criteria cannot be cited. However, all Missouri streams are protected by the general criteria found in the WQS at 10 Code of State Regulations (CSR) 20-7.031(3). The particular criteria that apply to Muddy Creek state:

- (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,
- (G) Waters shall be free from physical, chemical or hydrologic changes that would impair the natural biological community.

The designated beneficial uses of Muddy Creek are:

- Livestock and Wildlife Watering,
- Protection of Warm Water Aquatic Life,
- Protection of Human Health (Fish Consumption),
- Whole Body Contact Recreation - Category B, and
- Secondary Contact Recreation.

The use that is impaired is Protection of Warm Water Aquatic Life.

To address nutrient levels, the EPA nutrient ecoregion reference concentrations were targeted. To address TSS the 25th percentile of all TSS measurements available in the EDU were targeted. The TMDL LDC's represent flow under all possible stream conditions. The advantage of a LDC approach is that it avoids the constraints associated with using a single-flow critical condition and is applicable under all flow conditions. The LCs for TN, TP and TSS at the 50 percent flow exceedance (for the Missouri portion of the watershed only) are 86.03 lbs/day, 9.77 lbs/day and 1234.48 lbs/day, respectively.

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.

To address the impairment of unknown pollutants as listed in the EPA-approved 2008 Missouri 303(d) List, this TMDL targets sediment and nutrients.

To address nutrient levels, the EPA nutrient ecoregion reference concentrations were used. For Level III. Ecoregion 40 where Muddy Creek is located, the reference concentration for TN is 0.855 mg/L and for TP is 0.092 mg/L. The LC for TN and TP is defined by LDCs set at the Level III Ecoregion 40 reference concentrations. An established link between TSS, TN and TP pollutant targets with narrative WQS was defined by using the Level III Ecoregion 40 reference concentrations in the TMDL as numeric values. The TMDL uses a method to target specific concentrations at differing flows which will result in an annual average equal to the ecoregion target. As such, the ecoregion concentration will not be the target at all flows. These differing concentrations are calculated based on the range of current concentrations and a ratio adjustment such that the ecoregion targets are met.

A TMDL was developed establishing an allocation for suspended solids. Because sufficient pollutant data for the impaired stream was not available a reference approach was used. In this approach, the target or LC for pollutant loading is the 25th percentile of all data available within the Central Irregular Plains EDU in which Muddy Creek is located. An established link between TSS and sediment was used to define this TMDL as a numeric value.

The WLA, LA and MOS for all pollutants are set to not exceed the LC. Reductions in concentration for all pollutants should ensure the narrative WQS will be met.

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.

There are two site specific permits in the Muddy Creek watershed that have national pollutant discharge elimination system (NPDES) permits through the state of Missouri.

The Trenton Wastewater Treatment Plant (WWTP) (MO0039748) is located near the mouth of Muddy Creek and has the largest design flow, with an allowable discharge of 1.9 million gallons per day (MGD). The Trenton WWTP accounts for 98 percent of the total non-storm water design flows. This facility is the dominant point source discharger in the watershed and the 2007 biological assessment report notes relatively high levels of nutrients and chloride downstream. Peak flow from the lagoon is discharged from outfall #002 and is dependent upon actual storm water conditions. Peak flow from the retention basin is redirected through the main treatment plant. Sludge from the treatment plant is land applied. The Trenton WWTP must meet the requirements of an operating permit issued by MDNR. This permit contains discharge limits that the facility must meet to be protective of instream WQS. The current discharge permit was most recently reissued December 30, 2005, and expires December 29, 2010. Previous operating permits in Missouri authorized discharges of bypassed wastewater at some facilities during peak flow conditions. Changes to MDNR's regulations have removed this authorization and permits are now issued without bypass discharges being authorized. Discharges resulting from emergency diversion shall be considered an unauthorized bypass pursuant to 40 CFR § 122.41(m) and shall be reported, pursuant to 40 CFR § 122.41(m).

Mercer WWTP (MO0056057) has a permitted design flow of 0.048 MGD. Although this facility is upstream of the assessed impairment, its small size and location suggest that it is unlikely to be a significant contributor to the assessed aquatic life impairment. The outfall discharges to an unclassified tributary to Muddy Creek approximately 7 to 17 miles upstream of the visual benthic survey sites.

There are a five facilities with general permits and nine facilities with storm water permits (see Table 3 within the TMDL for these permit numbers), within the Muddy Creek watershed in Missouri. General permits are issued to entities that are similar enough to be covered by a single set of requirements. Storm water permits are issued to activities (e.g., land disturbance) that are similar enough to be covered by a single set of requirements and are expected to discharge in response to storm events. It should be noted that both municipalities located within the watershed in Missouri, Trenton and Mercer, each have populations under 10,000, and therefore are not required to obtain storm water permits issued for municipal separate storm sewer systems (MS4s).

The small portion of the Muddy Creek watershed that extends into Iowa contains only one site specific permit administered through the NPDES program. This facility is the city of Lineville's sewage treatment plant (IA9352001), with a permitted average wet weather design flow of 0.0344 MGD. The city of Clio does not have a central sewer system or a WWTP. There are no MS4s in the Iowa portion of the watershed.

Illicit straight pipe discharges of household waste are potential point sources in agricultural areas. These are discharges straight into streams or land areas and are different than illicitly connected sewers. There is no specific information on the number of illicit straight pipe discharges of household wastes in the Muddy Creek watershed.

Livestock operations where animals are maintained or fed under confined conditions but which maintain fewer than 300 animal units are not legally defined as concentrated animal feeding operations (CAFOs) under state regulations. Additionally, facilities that are defined as CAFOs but which maintain fewer than 1,000 animal units are not required to obtain a Missouri State Operating Permit. The National Agricultural Statistics Service (NASS) also reports there are a number of hogs and pigs, poultry layers and broilers in the counties containing the Muddy Creek watershed. There are no permitted poultry operations in and around the Missouri portion of the watershed but there are two permitted swine CAFOs within the watershed, each with storm water outfalls and each engaging in land application of animal waste. Although it is possible that there are also unregulated animal feeding operations (AFOs) within the watershed, these operations are not regulated by MDNR and there is no data available on their numbers or locations. Unregulated operations that do not properly manage animals or their waste may potentially be acting as point sources of nutrients and oxygen-consuming substances that could contribute to a water quality impairment in Muddy Creek.

Any CAFO that does not obtain an NPDES permit must operate as a no discharge operation. Any discharge from an unpermitted CAFO is a violation of Section 301. It is EPA's position that all CAFOs should obtain an NPDES permit because it provides clarity of compliance requirements, authorization to discharge when the discharges are the result of large precipitation events (e.g., in excess of 25-year and 24-hour frequency/duration) or are from a man-made conveyance.

Any permitted CAFOs identified in this TMDL would have been assigned a WLA. At this time, AFOs and unpermitted CAFOs are considered under the LA because we do not currently have enough detailed information to know whether these facilities are required to obtain NPDES permits. This TMDL does not reflect a determination by EPA that such facility does not meet the definition of a CAFO nor that the facility does not need to obtain a permit. To the contrary, a CAFO that discharges or proposes to discharge has a duty to obtain a permit. If it is determined that any such operation is an AFO or CAFO that discharges, any future WLA assigned to the facility must not result in an exceedance of the sum of the WLAs in this TMDL as approved.

Countywide data from the NASS were combined with the land cover data for the Muddy Creek watershed to estimate there are approximately 9,183 cattle in the Missouri portion of the watershed. The majority of the cattle being raised in this area are in cow-calf grazing operations. These cattle are therefore most likely located on the approximately 35,373 acres of grassland/pastureland in the Missouri side of the watershed and runoff from these areas can also be a potential source of nutrients and oxygen-consuming substances. Animals grazing in pasture areas deposit manure directly upon the land and, even though a pasture may be relatively large and animal densities low, the manure will often be concentrated near the feeding and watering areas in the field. These areas can quickly become barren of plant cover and increase the possibility of erosion and contaminated runoff during a storm event. When pasture land is not fenced off from the stream, cattle or other livestock may contribute nutrients directly to the stream while walking in or adjacent to the water body.

Employing a similar analysis using agricultural and land use data from Iowa, it is estimated there are roughly 627 cattle in the Iowa portion of the Muddy Creek watershed. This results in an overall livestock density of 48 cattle per square mile in the watershed. It should be noted this estimated density is variable and may be dependent upon the locations of any AFOs in Wayne County, Iowa.

Failing septic systems are sources of nutrients that can reach nearby streams through both surface runoff and ground water flows. The exact number of onsite wastewater systems in the Muddy Creek watershed is unknown. An estimate was made based on approximately 1,050 people in the rural watershed area with 2.5 persons per household gives potentially 420 systems.

Storm water runoff from urban areas can be a significant source of nutrients and oxygen consuming substances. Lawn fertilization can lead to high nutrient loads, and pet wastes can contribute both nutrient loads and oxygen-consuming substances. Phosphorus loads from residential areas can be comparable to or higher than loading rates from agricultural areas. Warmer storm runoff from urban areas such as parking lots and buildings can lead to higher water temperatures that lower the DO saturation capacity of streams. Excessive discharge of suspended solids from urban areas can also lead to streambed siltation problems. Approximately 4.6 percent of the Muddy Creek watershed is classified as urban and 91 percent of the urban land use is within the Missouri portion of the watershed. Of this Missouri portion of the land use, 91 percent is accounted for by the city of Trenton at the downstream end of the watershed. Fifty-eight percent of Trenton's incorporated area is within the watershed and Muddy Creek flows through this portion of the city. Trenton does not have a storm water management plan in place and is a likely contributor of urban nonpoint source runoff to Muddy Creek. Urban storm water runoff is considered a potentially significant source of substances and conditions contributing to the low DO problem. There are no MS4s within the Muddy Creek watershed.

The dominant land uses and land covers for the entire watershed are grassland (50.6 percent), cropland (24.2 percent) and forest/woodland (13.4 percent) with urban areas and land dominated by herbaceous vegetation occupying 4.6 and 3.5 percent of the watershed area, respectively.

The land uses and land covers for the Missouri portion of the watershed are grassland (50.6 percent), cropland (22.4 percent) and forest/woodland (14.4 percent) with urban areas and land dominated by herbaceous vegetation occupying 4.7 and 3.9 percent of the Missouri watershed, respectively.

The land use and land cover data indicate there are nearly 19,000 acres of cropland in the Muddy Creek watershed, which accounts for roughly 24 percent of the watershed area in both Iowa and Missouri. Land used for agricultural purposes can be sources of sediment, nutrients and oxygen-consuming substances in the stream. Accumulation of nitrogen and phosphorus on cropland occurs primarily from decomposition of residual crop material and fertilization with chemical and manure fertilizers, atmospheric deposition, wildlife excreta and irrigation water. Nutrients and organic materials from crop fields are transported to adjacent streams during precipitation events through the processes of surface runoff and soil erosion. These processes can be compounded by tilling of farm fields and by applying fertilizers prior to precipitation events or at rates exceeding the assimilative capacity of the soil. Roughly 87 percent of the soils in the Muddy Creek watershed in Missouri have slow or very slow infiltration rates and much of the upland area is considered highly or potentially highly erodible.

Riparian corridor conditions can also have a strong influence on nutrient and sediment loading to the stream and on instream DO. Wooded riparian buffers are instrumental in the detention, removal and assimilation of sediment and nutrients before they reach surface water. A stream with a good riparian zone is generally better able to moderate the impacts of high sediment and nutrient loads than a stream with a poor riparian zone.

In the riparian corridor adjacent to Muddy Creek, 27.2 percent of the land is classified as grassland. Non-native grassland provides limited riparian habitat and very little shading compared to wooded areas and can be subject to erosion nutrient loading associated with livestock activity. Another 17.6 percent of the riparian area is classified as cropland which, like grassland, provides limited riparian habitat compared to wooded areas and leaves these areas more susceptible to soil erosion and high nutrient loads.

The riparian area also includes land cover as forest (2.5 percent), wetland (41.5 percent) and herbaceous (3.8 percent). While these more naturally vegetated areas along the stream may serve to mitigate the effects of pollutants and conditions that may contribute to the aquatic life impairment, it should be noted that the riparian corridor in Muddy Creek comprises a very narrow zone within a floodplain dominated by row crop agriculture.

Significant portions of the Muddy Creek stream channel have been straightened or channelized. One of the primary effects of stream channelization is an increase in the velocity of water moving downstream. This increase in stream velocity can contribute to a reduction in base flows, which can be associated with increased water temperature and decreased levels of DO. Increased velocity can also lead to increased erosion of stream beds and stream banks which, can result in increased deposition of sediments downstream. Both erosion and sedimentation can have negative impacts on aquatic life.

Based on the information before us, the state's decision to apply the discharges associated with unpermitted sources to the LA, as opposed to the WLA for purposes of this TMDL, is acceptable. The decision to allocate these sources to the LA does not reflect any determination by EPA as to whether these discharges are, in fact, unpermitted point source discharges within this watershed. In addition, by approving these TMDLs with some sources treated as LAs, EPA is not determining that these discharges are exempt from NPDES permitting requirements. If sources of the allocated pollutant in this TMDL are found to be, or become, NPDES-regulated discharges, their loads must be considered as part of the calculated sum of the WLA in this TMDL. WLA in addition to that allocated here is not available.

All known sources have been considered.

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 LCs for TN, TP and TSS at the 50 percent flow exceedance (for the Missouri portion of the watershed only) are 86.03 lbs/day, 9.77 lbs/day and 1,234.48 lbs/day, respectively. For TN, TP and TSS, the MOS is implicit and the sum of the WLA and LA do not exceed the LC. It is assumed that point source loads from the Iowa portion of the watershed do not cause or contribute to the impairment and that all applicable WQS are met at the state line.

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.

The TMDL LDC represents the total LC of all point and nonpoint sources of pollutants. The sum of the WLAs represents allocations for all point sources of pollutants with both static and storm water-based design flows and the non-storm water curve represents allocations attributed to sources of discharge with static design flows. The only storm water-based design flow incorporated into the modeling is from the storm water lagoon (outfall #002) at the Trenton WWTP. Bypass discharges from this outfall will no longer be authorized as of the next permit renewal.

WLAs are presented as a sum for the two site-specific point source dischargers in the Missouri portion of the watershed. This TMDL does not include WLAs for point sources in Iowa.

As an example, at the 50 percent flow exceedance (for the Missouri portion of the watershed only) the sum WLA for TN is 16.65 lbs/day, for TP is 1.81 lbs/day and for TSS is 133.24 lbs/day.

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.

The LAs for the Muddy Creek TMDL are for all nonpoint sources of TN, TP and TSS. TMDL LAs for the entire Muddy Creek watershed were calculated based on the loads expressed in the LDCs. The LAs are intended to allow the nutrient and TSS targets to be met at all locations within the stream under a variety of flow conditions.

Because the Missouri portion of the Muddy Creek watershed accounts for 89.4 percent of the total watershed area, Muddy Creek stream flow, TMDL values and nonpoint source LAs were reduced proportionally from the allocations for the entire watershed. TMDL LAs for the Missouri portion of the Muddy Creek watershed can be found in Tables 7, 9 and 11 within the TMDL document. Allocations for the entire Muddy Creek watershed are provided in Tables 6, 8 and 10 within the TMDL document. It should be noted that nonpoint source loads contributed by the Iowa portion of the watershed are not considered to cause or contribute to the impairment, and it is assumed that all applicable WQS are met at the state line.

As an example, at the 50 percent flow exceedance (for the Missouri portion of the watershed only) the LA for TN is 69.39 lbs/day, for TP is 7.96 lbs/day and for TSS 1,101.23 lbs/day.

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.

An implicit MOS was incorporated into the TMDL based on conservative assumptions used in the development of the TMDL LDCs. Among the conservative approaches used was to target the 25th percentile of all TSS concentration data available in the EDU in which Muddy Creek is located. The use of ecoregion nutrient targets in lieu of national or state-wide nutrient targets helps ensure that implementation will result in minimally impacted stream systems. TN and TP targets are conservative because they are based on the 25th percentile of all TN and TP data gathered from reference streams in ecoregion 40, where data are not directly influenced by permitted dischargers. The 25th percentile is considered a surrogate for establishing a reference population of minimally impacted waters. The targets are the median calculated from the four seasonal 25th percentile values.

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.

Federal regulations at 40 CFR § 130.7(c)(1) require that TMDLs take into consideration seasonal variation in applicable standards. The Muddy Creek TMDL takes seasonal variation into account through the use of LDCs. LDCs represent the allowable pollutant load under different flow conditions and across all seasons. The results obtained using the LDC method are more robust and reliable over all flows and seasons when compared with those obtained under critical low-flow conditions and avoids the constraints associated with using a single-flow critical condition.

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 water quality limited segment of Muddy Creek is included on the EPA approved 2008 Missouri § 303(d) List. The public notice period for the draft Muddy Creek TMDL was May 5 to July 8, 2010. Before finalizing the Muddy Creek TMDL the public was notified of a 45 day comment period. Public notices to comment on the draft Muddy Creek TMDL were distributed via mail and e-mail to major stakeholders in the watershed or other potentially impacted parties. In addition, since the headwaters of Muddy Creek originate in Iowa and flow into Missouri, a public notice announcement was sent to the Iowa Department of Natural Resources' Water Quality Bureau. Announcement of the public notice period for this TMDL was also issued as a press release to local media outlets in the proximity of the Muddy Creek watershed. Finally, the public notice, the TMDL Information Sheet and this document were posted on MDNR's website, making them available to anyone with Internet access. Any comments received, and MDNR's response to those comments, have been placed in the Muddy Creek administrative record. Three public comments were received and the TMDL was edited accordingly.

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].

MDNR has not yet scheduled post-TMDL monitoring for Muddy Creek. MDNR may schedule and conduct such monitoring approximately three years after the TMDL is approved, or in a reasonable period of time following implementation of nonpoint source best management practices (BMPs). MDNR will routinely examine physical habitat, water quality, the invertebrate community and fish community data collected by other local, state and federal entities in order to assess the effectiveness of TMDL implementation. One example of such data is that generated by the Resource Assessment and Monitoring Program administered by the Missouri Department of Conservation. This program randomly samples streams across Missouri on a five to six year rotating schedule.

Another example of data that may be of use to assess the effectiveness of TMDL implementation is data collected

by stream teams as part of the volunteer water quality monitoring program. Although data is not currently being collected on Muddy Creek as part of this program, monitoring is taking place on other nearby streams in Mercer and Grundy counties. Given this proximity of individuals trained in water quality data collection, it may be possible to establish a similar monitoring program using these same volunteers on Muddy Creek. MDNR also may work with the local soil and water conservation districts to encourage members of their staff or the interested public – including landowners participating in the Agricultural Nonpoint Source Special Area Land Treatment (AgNPS SALT) project – to obtain volunteer water quality monitoring training that is offered by MDNR.

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.

Reasonable assurances are not required within this TMDL because all permitted point sources have received a WLA that is set to meet WQS.

MDNR has the authority to issue and enforce Missouri State Operating Permits. Inclusion of effluent limits into a state operating permit and requiring that effluent and instream monitoring be reported to MDNR should provide reasonable assurance that instream WQS will be met. Section 301(b)(1)(C) requires that point source permits have effluent limits as stringent as necessary to meet WQS. However, for WLAs to serve that purpose, they must themselves be stringent enough so that (in conjunction with the water body's other loadings) they meet WQS. This generally occurs when the TMDL's combined nonpoint source LAs and point source WLAs do not exceed the WQS-based LC and there is reasonable assurance that the TMDL's allocations can be achieved. Any discussion of reduction efforts relating to nonpoint sources would be found in the implementation section of the TMDL.

The Mercer County Soil and Water Conservation District is in the process of administering a seven year AgNPS SALT grant that was received in 2005. BMPs being implemented as part of this project are intended to address and improve agricultural land use practices that may be contributing to water quality problems associated with nonpoint source pollution in the Muddy Creek watershed. Activities or practices being implemented include various forms of pasture and cropland management, erosion control, groundwater protection, waste management, and riparian and stream bank protection. In addition, educating and providing information to landowners, including distributing newsletters and brochures and conducting workshops and field tours, is an important component of this AgNPS SALT project.

The primary mechanism for measuring the success of this project is through the completion of semi-annual progress reports that evaluate the proportion of project goals completed, based on the importance assigned to each category. Measurements of water quality improvement in Muddy Creek rely on monitoring to be conducted by MDNR, as well as biological monitoring to be conducted by local stream team volunteers throughout the life of the project.