



EPA Region 7 TMDL Review

TMDL ID:MO_0442

State: MO

Document Name: HICKORY CREEK

Basin(s): GRAND-UPPER GRAND RIVER BASIN

HUC(s): 10280101

Water body(ies): HICKORY CREEK

Tributary(ies):

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

Submittal Date:6/10/2010

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 June 10, 2010. Revisions to this document were received by email on October 7 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.

The Hickory Creek TMDL was developed to address the unknown pollutant impairment of the Hickory Creek segment MO_0442. A TMDL is needed for Hickory Creek because it is not meeting the narrative WQS for general criteria. Evidence of impairment was primarily narrative rather than numeric, as indicated by the presence of duckweed and dense filamentous algae. These observations indicate that nutrient enrichment was negatively impacting the stream. "Rocks darkened by manganese," which may indicate anoxic conditions, were also noted. The 2006-2007 Versar study identified the stressors, or possible causes of impairment, as low dissolved oxygen (DO) levels, increased silt and sediment in the stream, poor habitat quality and low or altered flow regime. The two water quality studies show impairment of the aquatic community at low flow or drought conditions and a healthy aquatic community at higher flows. During both flow regimes, there are problems with excessive sedimentation and nutrients. Targeting sediment will ensure already limited in-stream habitat is protected from additional sedimentation, and targeting nutrients will ensure these pollutants do not cause or contribute to a DO impairment or conditions that would lead to an exceedance of the narrative criteria. A combination of natural geology and land use in the prairie portions of the state where Hickory Creek is located is believed to have reduced the amount and impaired the quality of habitat for aquatic life.

In the EPA approved 2008 Missouri 303(d) List, Hickory Creek is listed as impaired by unknown pollutants. Water quality monitoring has not revealed an exceedance of a specific numeric WQS; however, TSS, TN and TP have been identified as the likely contributors to the impairment. The TMDLs for TSS, TN and TP were determined using load duration curves (LDCs). If met, the TMDL targets will be protective of the designated aquatic life use and should result in WQS attainment.

To address nutrient levels, the EPA nutrient ecoregion reference concentrations were used. For the ecoregion where Hickory Creek is located, the reference concentration for TN is 0.855 milligrams per liter (mg/L) and for TP is 0.092 mg/L. The LC for TN and TP is defined by LDCs set with available ecoregion TN and TP data adjusted so the median equals the ecoregion reference concentrations. 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 sediment, such as TSS, turbidity and bedload sediment, which are appropriate to describe sediment in rivers and streams. Because fine particle size sediment and suspended particles of organic matter are derived from similar loading conditions, TSS will be used to represent both. 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 conditions and monitoring data. 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 TSS, TN and TP at the 50 percent flow exceedance are 0.08 tons per day (tons/day), 12.95 pounds per day (lbs/day) and 1.39 lbs/day, respectively. These reductions in nutrients and sediment protects the warm water aquatic life use of the stream and the TMDLs should result in WQS attainment.

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.

All water bodies in Missouri are protected by the general narrative criteria contained in Missouri's WQS CSR 20-7.031(3) pertaining to the protection of aquatic life. These criteria are also called narrative criteria, since they do not contain specific numeric limits. The narrative criteria not being met in Hickory Creek are (3)(A), (C), (D) and (G):

- 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 Hickory Creek are:

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

The use that is impaired is general criteria pertaining to protection of warm water aquatic life.

In the absence of Missouri numeric standards for nutrients in freshwater streams, ambient water quality criteria recommendations provided by the EPA nutrient Ecoregion 40 reference concentrations were used to quantify TN and TP LCs in Hickory Creek. Reference conditions for TN and TP in Level III Ecoregion 40 streams are as follows: TN = 0.855 mg/L and TP = 0.092 mg/L.

A concentration of TSS was selected to represent the numeric target for this TMDL because it enables the use of available data and is included in monitoring data. To address TSS the 25th percentile of all available TSS measurements available in the EDU were targeted. TSS target is 10 mg/L.

The TMDL LDCs 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 TSS, TN and TP at the 50 percent flow exceedance are 0.08 tons/day, 12.95 lbs/day and 1.39 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 unknown pollutant, this TMDL targets sediment and nutrients. Evidence of duckweed and dense filamentous algae indicate that nutrient enrichment is negatively impacting the stream. "Rocks darkened by manganese," may indicate anoxic conditions. The stressors, or possible causes of impairment, are low DO levels, increased silt and sediment in the stream, poor habitat quality and low or altered flow regime. Two water quality studies show impairment of the aquatic community at low flow or drought conditions and a healthy aquatic community at higher flows. During both flow regimes, there are problems with excessive sedimentation and nutrients. Excessive sedimentation clouds the water, which reduces the amount of sunlight reaching aquatic plants, covers fish spawning areas and food supplies, and clogs the gills of fish. Other pollutants like nitrogen, phosphorus, pathogens and heavy metals are often attached to soil particles and move into streams with the sediment.

To address nutrient levels, the EPA nutrient ecoregion reference concentrations were used. For Level III Ecoregion 40 where Hickory 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 Hickory Creek is located. An established link between TSS and sediment was used to define this TMDL as a numeric value.

The sum of the WLA, LA and MOS for all pollutants are set to not exceed the LC. Reductions in concentrations for all pollutants should ensure the narrative WQS are 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 is one facility with a site specific permit (MO0118460) and two facilities with general permits in the Hickory Creek watershed. All the discharge outfalls for Continental Grain's (CG) Campbell Creek Farm (MO0118460) are not located in the Hickory Creek watershed. The facility does conduct water quality monitoring at one site on Hickory Creek identified as "outfall #15." The general permits do not normally discharge to the impaired stream, but do have storm water runoff during rain events. There is one permitted concentrated animal feeding operation (CAFO) in the Hickory Creek watershed (MOG010475).

Permits		
Facility	Permit number	Design Flow Million Gallons/Day
CG Campbell Creek Farm	MO0118460	0.457
Hickory Creek Farms	MOG010475	General Permit (0.0578)

The presence of pastured livestock could be contributing to nutrient and sediment loads. The cattle are most likely located on approximately 5,191 acres of grassland/pastureland in the watershed. Runoff from these areas can be potential sources of nutrients, sediment from erosion and oxygen-consuming substances. Animals grazing in pasture areas deposit manure directly upon the land surface 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, increasing the possibility of erosion and contaminated runoff during a storm event. Grassland makes up 38.8 percent of the watershed land use. The density of cattle in the Hickory Creek watershed (160 cattle per square mile) suggests they are not a potentially significant source of pollutants unless they are directly accessing the creek.

National Agricultural Statistics Service also indicates there are 96,000 and 45,000 hogs/pigs in Daviess and Harrison Counties, respectively.

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 Hickory Creek watershed.

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 Hickory Creek watershed is unknown. An estimate was made based on approximately 155 people in the rural watershed area, with 2.5 persons per household, this gives 62 systems potentially in the entire watershed.

Storm water runoff from urban areas can be a significant source of nutrients and sediment loads. Phosphorus loads from residential areas can be comparable to or higher than loading rates from agricultural areas. Excessive discharge of suspended solids from urban areas can also lead to streambed siltation problems. Since approximately 2.9 percent of the Hickory Creek watershed is classified as urban, it is unlikely urban storm water runoff is a significant source of substances and conditions contributing to the pollutants of concern.

Lands used for agricultural purposes can be a source of nutrients and oxygen-consuming substances. Accumulation of nitrogen and phosphorus on cropland occurs from decomposition of residual crop material, fertilization with chemical and manure fertilizers, atmospheric deposition, wildlife excreta and irrigation water. The land use/land cover data indicates that there are 4,794 cropland acres which accounts for approximately 36 percent of the watershed's area.

Other types of land use in Hickory Creek includes forest and woodland (21.6 percent), open water (0.7 percent) and impervious (0.1 percent).

Riparian areas can be sources of natural background material that could possibly contribute to the impairment. Only 7.8 percent of the riparian corridor is noted as cropland and 8.1 percent is grassland. Forest and woodland account for 82.4 percent of the riparian corridor, but a large portion of the riparian forest was being harvested during a site visit in 2006. This activity will likely result in negative impacts to the stream as the banks will continue to destabilize. In general, a lack of good riparian habitat conditions should be considered as contributing to water quality problems in Hickory Creek.

In the absence of a national pollutant elimination discharge system (NPDES) permit, the discharges associated with sources were applied to the LA, as opposed to the WLA for purposes of this TMDL. 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 establishing 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 WLAs in this TMDL. WLA in addition to that allocated here is not available.

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.

Animal Feeding Operations (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.

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 TSS, TN and TP at the 50 percent flow exceedance are 0.08 tons per day, 12.95 lbs/day and 1.39 lbs/day, respectively. For TSS, TN and TP: the LAs are set equal to the LCs, the MOS is implicit, the WLAs are zero and the sum of the WLA and LA do not exceed the LC.

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 the present time, no portion of the TMDL LC will be allocated to point sources and WLAs are set at current permit limits and a WLA of zero (0).

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 Hickory Creek TMDL are for all nonpoint sources of TN, TP and TSS. Because no WLAs were assigned, the TMDL LC and LA for each flow will be equal.

As an example, at the 50 percent flow exceedance, the LA for TSS, TN and TP are 0.08 tons per day, 12.95 lbs/day and 1.39 lbs/day, respectively.

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 LDCs. The use of regional ecoregion targets in lieu of national or state wide targets serves to ensure that implementation will result in minimally impacted stream systems. The 25th percentile is considered a surrogate for establishing a reference population of pristine or minimally impacted systems.

TN and TP are conservative because they are based on the 25th percentile of all TN and TP data gathered from Central Irregular Plains (Level III 40) of Aggregate Nutrient Ecoregion IX, where data are not directly influenced by permitted dischargers.

In the case of nutrients, the targets are the median calculated from the four seasonal 25th percentile values. Both

high concentrations seen during the periods of spring runoff and winter flow from snowmelt, and low concentrations seen during low flow conditions in both summer and fall, do not effectively affect the annual reference targets.

In the case of sediment, the approach used was to target the 25th percentile of all concentration data available in the Central Plains/Grand/Chariton EDU in which Hickory Creek is located. The use of these refined and/or EDU specific data ensures that all geological and landscape conditions are addressed in the TMDL.

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 impairment of Hickory Creek is by unknown pollutants and unknown sources. The critical condition is during low flow conditions. The TMDL LDC represents flow under all possible stream conditions and seasons and avoids the constraints associated with using a single-flow critical condition. Annual low-flow conditions in Missouri typically occur between July 1 and September 15. When flow is at its lowest, and there is effectively no flow from nonpoint sources, points source discharges would have the greatest impact on stream integrity. Low flow conditions affect nutrient yields, sediment loads and DO levels, all of which can put stress on aquatic communities. Low water levels also limit the amount of available habitat for aquatic communities by reducing the amount of available water. Using a LDC for TMDL development during these conditions will be protective.

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 the Hickory Creek is included on the EPA-approved 2008 303(d) List for Missouri. The public notice period for the draft Hickory Creek TMDL was from April 13 to May 28, 2010. The public notice, the TMDL Information Sheet and the TMDL document were posted on the MDNR Website, making them available to anyone with Internet access. The public notice announcement was also sent to a variety of interest groups. No comments were received regarding this TMDL.

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 will routinely examine physical habitat, water quality, and invertebrate and fish community data collected by other state and federal agencies 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.

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 there are no regulated or permitted point source and the WLA is zero.

MDNR has the authority to issue and enforce 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. Discussion of reduction efforts relating to nonpoint sources can be found in the implementation section of the TMDL.