



EPA Region 7 TMDL Review

TMDL ID:KS-SS-07-540_5

State: KS

Document Name: BIG CREEK -- BACTERIA

Basin(s): SMOKY HILL/SALINE RIVER

HUC(s): 10260007

Water body(ies): BIG CREEK

Tributary(ies): CHETOLAH CREEK (8), MUD CREEK (9), NORTH FORK BIG CREEK (4),
OGALLAH CREEK (6), WALKER CREEK (2)

Pollutant(s): E. COLI

Submittal Date:8/12/2010

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 Kansas Department of Health and Environment (KDHE). The United States Environmental Protection Agency (EPA) received this TMDL document by email on August 12, 2010. Revised versions of the TMDL were submitted by email attachment on August 23 and 25, 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.

Based on the intensive sampling (five times within 30 days) of *Escherichia coli* (*E. coli*) bacteria data collected at Stream Monitoring Station SC540 (Munjor) in April and June 2006, Big Creek is impaired for primary contact recreation. The geometric means (geomeans) of April (382 colony forming units (CFU) per 100 milliliters (ml)) and June (788 CFU/100 ml) exceeded the criteria for primary contact recreation Class B (262 CFU/100 ml) and Class C streams (427 CFU/100 ml). The data collected by the Big Creek Middle Smoky Hill Watershed Restoration and Protection Strategy (WRAPS) during 2007 through 2009, also indicated routine exceedance of the criteria, particularly during runoff events occurring in the recreational period from April to October.

The LC for *E. coli* bacteria is set, based on the geomean of 262 *E. coli* CFU/100 ml for Class B streams and the geomean of 427 *E. coli* CFU/100 ml for the recreation period. The LC is expressed with a load duration curve (LDC), which uses stream discharge and a WQS target to define the LC at all percentiles of flow exceedance. The LCs for each of the individual impaired segments are given in the table below. These LCs will result in the achievement of WQS in the targeted segments.

Segment ID	Flow Condition (percent flow exceedance)	LC (x10 ⁹ CFU/day) (April 1 - October 31)
Big Creek (1)	90	60.50
	75	90.93
	50	212.49

	25	388.24
	10	632.23
Big Creek (5)	90	11.85
	75	22.74
	50	75.91
	25	152.79
	10	242.48

Though Big Creek (3) is classified as a secondary contact recreation stream (Class b) that has a WQS value of 3,843 CFU/100 ml, the Class C criterion of 427 *E. coli* CFU/100 ml is targeted in the TMDL to achieve a better water quality protection.

Segment ID	Flow Condition (percent flow exceedance)	LC ($\times 10^9$ CFU/day) (April 1 - October 31)
Big Creek (3)	90	59.77
	75	75.28
	50	150.98
	25	260.43
	10	388.12

Numeric Target(s)

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

The WQS for the impaired segments covered by the monitoring site SC540 are given below.

Segment ID	Designated Uses	Impaired Use	Primary Contact Recreation WQS
Big Creek (1) Big Creek (5)	Expected Aquatic Life support, Food Procurement, Domestic Water Supply, Industrial, Irrigation and Livestock Watering, Groundwater Recharge, Primary Contact Recreation (1 for Class C and 5 for Class B)	Primary Contact Recreation	Primary Contact: April 1 - October 31 262 CFU/100 ml for Class B 427 CFU/100 ml for Class C Non-Primary Contact: November 1- March 31 2,358 CFU/100 ml for Class B 3,843 CFU/100 ml for Class C

These segments are given High Priority for TMDL development in the State's 303(d) list.

The following table lists the secondary contact recreation segments (Class a and Class b) that, although not listed as impaired, are included for further ensuring that the water quality goal of this TMDL meets the requirement of the Clean Water Act.

Main stem	Tributary	Secondary Contact Recreation WQS
Big Creek (3, Class b) Big Creek (7, Class b)	Walker Creek (2, Class b) Ogallah Creek (6, Class b) North Fork Big Creek (4, Class b) Mud Creek (9, Class b) Chetolah Creek (8, Class a)	January 1 - December 31 2,358 CFU/100 ml for Class a 3,843 CFU/100 ml for Class b

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.

As indicated previously, the intensive sampling of *E. coli* bacteria data collected at Station SC540 indicates that Big Creek is impaired for primary contact recreation. The numeric *E. coli* bacteria targets of 262 and 427 CFU/100 ml are set to address the pollutant causing the impairment on the primary contact recreation Class B and Class C segments, respectively. The linkage of the *E. coli* bacteria impairment to the sources is direct, based on the stream monitoring data (SC540, SC541, SC715, WRAPS) and LDC analysis. Bacteria loads are allocated to the major contributors so that maximum daily loads can be quantitatively determined and mitigated.

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 six National Pollutant Discharge Elimination System (NPDES) permitted facilities that discharge or can potentially discharge effluent to Big Creek. Two of the facilities are dry batch, ready mix concrete plants (KSG110186 and KSG110018). Although their wastewater is directed toward the City of Hays wastewater collection and treatment system, neither of these two plants discharged over the period 2003 – 2009. The City of Wakeeney (KS0099309) operates a three-cell lagoon wastewater system (0.25 million gallons per day or MGD). The effluent from Wakeeney does not often flow down channel toward Ellis. Observations made during use attainability analysis (UAA) found the channel of Big Creek dry in Trego County where the Wakeeney wastewater treatment facility (WWTF) is located. The City of Ellis (KS0094145) operates a low volume activated sludge treatment plant (0.3 MGD), whose effluent typically does not reach Hays according to observations by Division of Water Resources field personnel. The city of Gorham (KS0096610) is now being updated to discharge (0.0478 MGD) to Walker Creek in late 2010. The City of Hays (KS0036684) discharges its effluent (2.8 MGD) to Big Creek and can have significant impacts on its water quality. The bacteria loads from these WWTFs are established by existing permit limits that are below the current WQS during the primary contact recreation period. These permit limits are met through disinfection and long retention of wastewater in the facilities. The analysis of the wastewater data from Discharge Monitoring Records indicates that effluent from these WWTFs is not responsible for the high bacteria levels observed in Big Creek. Besides these six NPDES facilities, there are an additional eight non-discharging facilities (KSJ000118, KSJ000316, KSJ000116, KSJ000311, KSJ000331, KSJ000332, KSJ000329, and KSJ000330) that do not introduce bacteria loads to Big Creek.

The elevated bacteria levels in Big Creek are primarily related to urban storm water and, in particular, agricultural nonpoint sources. Cropland is the predominant land use in the watershed, comprising 62 percent of the total watershed area. Although row crop production in the vicinity of Big Creek can contribute bacteria load to the surface water via overland flow if the areas are associated with manure application, grassland is the more likely source of bacteria during runoff events because of grazing possibilities. Grassland tends to be located on the southern portion of the watershed and in the headwater areas of some of the tributaries. The greatest percentage of acres in grassland occurs in the drainage lying between Ellis and Hays. The bacteria loads from these areas may be a primary source contributing to the bacteria impairment.

There are 44 certified, permitted or registered animal feeding operations in the watershed. All of these livestock facilities have waste management systems designed to minimize runoff entering their operations and detain runoff emanating from their facilities. These facilities are designed to retain a 25-year, 24-hour rainfall/runoff event as well as an anticipated two weeks of normal wastewater from their operations. Typically, this rainfall event coincides with streamflow that occurs less than 1-5 percent of the time. Though the total potential number of animals is approximately 47,600 animal units, the actual number of animals at these feedlot operations is typically less than the allowable permitted number. Based on Kansas Agricultural Statistics, most cattle are located in Gove and Ellis Counties as are the cattle in the confined animal feeding operations. There are livestock present in Russell County but no regulated facilities in the Big Creek drainage portion of the county. These non-regulated feeding facilities may contribute the elevated bacteria levels seen in lower Big Creek.

Permitted concentrated animal feeding operations (CAFOs) identified in this TMDL are part of the assigned WLA. 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

NPDES Number	KS Permit Number	Facility Name	Design Flow (MGD)	(10 ⁹ CFU per day)	(10 ⁹ CFU per day)
KS0036684	M-SH16-OO02	City of Hays WWTF	2.8	16.9	249.7
KS0094145	M-SH06-OO02	City of Ellis WWTF	0.3	1.8	26.5
KS0099309	M-SH38-OO02	City of Wakeeney WWTF	0.25	36.6	36.6
KS0096610	M-SH10-OO01	City of Gorham WWTF	0.0478	6.6	6.6
KSG110186	I-SH16-PR02	Ellis County Concrete	0.0	0.0	0.0
KSG110018	I-SH16-PR01	APAC-KS-Shears (Hays Plant #601)	0.0	0.0	0.0
KSJ000118	M-SH37-NO01	City of Victoria	0.0	0.0	0.0
KSJ000316	M-SH50-NO01	Munjoy Improvement District	0.0	0.0	0.0
KSJ000116	I-SH16-NP05	APAC-KS-Shears (Hays Plant #921)	0.0	0.0	0.0
KSJ000311	M-SH38-NR02	KDOT – Trego Co Rest Area	0.0	0.0	0.0
KSJ000331	M-SH12-NR02	KDOT – Gove Co Rest Area	0.0	0.0	0.0
KSJ000332	M-SH14-NO01	City of Grinnell	0.0	0.0	0.0
KSJ000329	M-SH12-NO01	City of Grainfield	0.0	0.0	0.0
KSJ000330	M-SH12-NO02	USD#292 Grainfield-Wheatland School	0.0	0.0	0.0

The Big Creek watershed covered by this TMDL has 44 certified, permitted or registered animal feeding operation sites. Because these feeding operation sites are non-discharging facilities, their WLA is assigned zero. The city of Hays has a MS4 NPDES storm water permit (M-SH16-SN01; KSR044008). The permit follows a general permit format, requiring the six minimum controls to be implemented throughout the corporate limits of Hays. Part III of the permit lists required best management practices to attenuate bacteria loading. The following table lists the required WLA for this MS4 at various flow conditions from April to October.

MS4	Flow Condition (percent flow exceedance)	WLA (x10 ⁹ CFU/day) (April 1 - October 31)
City of Hays (KSR044008; M-SH16-SN01)	90	0.00
	75	3.92
	50	4.07
	25	5.44
	10	7.72

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 LA is set by $LA = TMDL - WLA - MS4 - MOS$. The LAs for the three targeted segments, which include their tributaries in calculation, are given in the table shown below.

Segment ID	Flow Condition (percent flow exceedance)	LA (x10 ⁹ CFU/day) (April 1- October 31)
Big Creek (1)	90	31.02
	75	40.77
	50	146.52
	25	320.90
	10	562.60
Big Creek (3)	90	31.02
	75	31.72
	50	91.61
	25	199.69

	10	325.10
Big Creek (5)	90	0.00
	75	0.00
	50	37.51
	25	114.39
	10	204.08

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.

This TMDL uses an implicit margin of safety, based on the conservative assumptions tied to assessing attainment to the primary contact recreation Class B and Class C criteria (262 and 427 CFU/100 ml, respectively). First, the waste loads from Hays, Ellis and Wacency are established by existing permit limits that are below the WQS, and these permit limits can be easily met through disinfection and long retention of wastewater. Second, the waste loads of Ellis and Wacency and Gorham are established even though there is strong evidence those waste loads will not transport down Big Creek since low bacteria concentration are typically observed at SC541 at Hays. Finally, even though the majority of Big Creek will not hydraulically support primary recreation (limited depth) except under runoff conditions, the primary criteria will be applied as the endpoints for this TMDL at any flow condition from April 1 to October 31. In addition, the Class C criterion of 427 *E. coli* CFU/100 ml is targeted on Big Creek Segment 3 in the TMDL, though this segment is classified as a secondary contact recreation that has the WQS value of 3,843 CFU/100 ml, to achieve a better water quality protection.

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.

Seasonality and any critical conditions have been incorporated in the TMDL. This TMDL was developed using the LDC analysis, based on the primary contact recreation WQS. Five flow conditions, including the critical (or low) flows, were addressed in the LDC analysis. Because the primary contact recreation period (April 1 - October 31) was incorporated in the analysis, this TMDL has evaluated the seasonal variability and critical conditions of bacteria loads.

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)].

The Smoky Hill – Saline River Basin Advisory Committee met in Hays to discuss all TMDLs (including this TMDL) in the basin on July 7, 2009, October 1, 2009, and again on March 3, 2010. An active Internet Web site was established at www.kdheks.gov/tmdl/ on January 28, 2010, to convey the TMDL information to the public. A Public Hearing on this TMDL was held on February 10, 2010 in Hays, to receive comments on this TMDL. During the public notice period, though no public comments were received by KDHE, EPA provided comments to the agency. These comments were properly addressed and incorporated into the TMDL.

EPA agrees there has been ample opportunities for the public to participate and submit their comments to KDHE for 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].

KDHE will continue to collect quarterly to bimonthly samples every year at Stations SC540 (near Munjor) and SC541 (near Hays) and at the new station SC752 (near Russell). The stream will be evaluated for possible

delisting in 2020. Storm water monitoring should be continued by the Big Creek WRAPS and the City of Hays Storm Water Program. Periodic sampling should be made by the WRAPS at its stations in Ellis and Russell Counties. Monthly single samples should be drawn from Ellis City Lake and the impounded portion of Big Creek in Frontier Park (in Hays) during June, July and August since these areas present the greatest opportunity for primary recreation on Big Creek.

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.

No reasonable assurances apply because all of the permitted point sources have WLAs assigned to meet WQS. However, several reasonable assurances were identified in this TMDL including the state authorities used to control pollutant loads from the NPDES permitted facilities in the watershed (i.e., KSA 65-164, 65-165, and 65-171d).

KDHE 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 KDHE 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.

The analysis of the wastewater data from Discharge Monitoring Records indicates that the episodes of elevated bacteria concentrations seen at the Hays WWTF were associated with storm water inflow or infiltration into the sanitary sewer system, while some slightly elevated levels seen in the Ellis WWTF were related to operational issues. This analysis concludes that effluent is not responsible for the high bacteria levels observed in Big Creek.

The elevated bacteria levels in Big Creek are primarily related to urban storm water and agricultural runoff from the grazing areas. Therefore, several implementation activities are required to establish reasonable assurance, and are provided in the TMDL for reduction of both WLA and LA, as follows.

1. Facilitate urban storm water management in Hays to abate pollutant loads.
2. Improve riparian conditions along stream systems by limiting overuse from grazing livestock along the stream.
3. Provide alternative water supplies for livestock to limit their use of streams as water sources.
4. Ensure land applied manure is being properly managed and is not susceptible to runoff into nearby streams.
5. Install pasture management practices, including proper stock density to reduce soil erosion and storm runoff.