



## EPA Region 7 TMDL Review

TMDL ID:KS-SS-07-540\_5

State: KS

Document Name: BIG CREEK -- TSS

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): TOTAL SUSPENDED SOLIDS

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 Department (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, 25 and 26, 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 total suspended solids (TSS) data collected at Stream Monitoring Station SC540 (Munjor) over 1990 to 2009, Big Creek is impaired for designated use of Expected Aquatic Life. The median TSS value was 72 milligrams per liter (mg/L), which exceeds the level (50 mg/L) that a stream is unlikely to support a rich diversity of aquatic life. Because the median value at the upstream site (SC540) was 43 mg/L, this TMDL was developed to address the impaired segments (1, 3, 5) between the city of Hays and the Big Creek's confluence with Smoky Hill River.

The endpoint of this TMDL is to achieve the WQS by eliminating any of the impacts to aquatic life associated with excessive suspended solids as described in the narrative criteria pertaining to solids; "Suspended solids added to surface waters by artificial sources shall not interfere with the behavior, reproduction, physical habitat, or other factors related to the survival and propagation of aquatic or semi aquatic life or terrestrial wildlife. In the application of this provision, suspended solids associated with discharges of presedimentation sludge from water treatment facilities shall be deemed noninjurious to aquatic and semiaquatic life and terrestrial wildlife, if these discharges comply fully with the requirements of paragraphs (b)(6) and (8) and paragraph (c)(2)(D) of this regulation." (K.A.R. 28-16-28e(c)(2)(B)).

The LC for TSS is set at 43 mg/L since this value falls below the impairment level of 50 mg/L. 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 and full restoration of the designated use in the targeted segments.

Segment ID	Flow Condition (percent flow exceedance)	LC (lbs/day)
Big Creek (1)	90	1511.62
	75	2340.77
	50	5789.02
	25	10774.45
	10	17456.80
Big Creek (3)	90	1495.37
	75	1992.74
	50	4421.09
	25	7931.95
	10	12027.96
Big Creek (5)	90	429.57
	75	824.31
	50	2751.57
	25	5537.97
	10	8788.77

#### 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.*

As indicated in the previous section, the endpoint of this TMDL is to achieve the WQS by eliminating any of the impacts to aquatic life associated with excessive suspended solids as described in the narrative criteria pertaining to solids. TSS can be highly variable in stream and river systems and have strong linkages to stream discharge. Kansas Administrative Regulations (KAR) specifies that "Suspended solids added to surface waters by artificial sources shall not interfere with the behavior, reproduction, physical habitat, or other factors related to the survival and propagation of aquatic or semiaquatic life or terrestrial wildlife."

KDHE analyzed 15 years of TSS data and associated biological monitoring data. A strong threshold relationship exists at 50 mg/L median TSS, above which streams are unlikely to support a rich diversity of aquatic life. This TMDL will be established to meet the endpoint of reducing existing median concentrations of TSS on the lower reaches of Big Creek to the median TSS seen at the upstream station (43 mg/L) to ensure good biological conditions that can be fully restored on the lower reaches.

The endpoint of this TMDL for the impaired segments are given below.

Segment ID	Designated Uses	Impaired Use	TMDL Endpoint
Big Creek (1) Big Creek (3) Big Creek (5)	Expected Aquatic Life support, Food Procurement, Domestic Water Supply, Industrial, Irrigation and Livestock Watering, Groundwater Recharge, Primary Contact Recreation	Expected Aquatic Life	43 mg/L

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

The following table lists the tributaries, although not listed as impaired, to further ensure that the water quality goal of this TMDL fully meets the requirement of the Clean Water Act.

--	--	--	--

Main stem	Tributary	Designated Uses	TMDL Endpoint
Big Creek (7)	Walker Creek (2) Ogallah Creek (6) North Fork Big Creek (4) Mud Creek (9) Chetolah Creek (8)	Expected Aquatic Life support, Food Procurement (4, 7), Domestic Water Supply, Industrial, Irrigation and Livestock Watering, Groundwater Recharge (2, 4, 7), Secondary Contact Recreation	43 mg/L

#### 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.*

Pollutant of concern for Big Creek is listed as TSS. In the absence of numeric standards for TSS in freshwater streams, a concentration of TSS was selected to represent the numeric target for this TMDL. The TSS target (43 mg/L) was derived based on Site SC541, which falls below the level (50 mg/L). A stream that has a median TSS level less than 50 mg/L is most likely to support a rich diversity of aquatic life, based on the analysis of 15 years of TSS and biological data.

There is an established link between the TSS and its contributing sources, based on the stream monitoring data (SC540, SC541, SC715, WRAPS) and load duration curve (LDC) analysis. Aquatic life use is impaired in Big Creek due to excessively high levels of TSS from urban and agricultural activities. The largest TSS loads typically occur during spring and summer runoff. The TSS loads are smallest in the winter months because of the low streamflow. For this TMDL, TSS loads are allocated to the major contributors so that maximum daily loads can be quantitatively determined and mitigated to protect aquatic life in the stream.

#### 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 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 to 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 WLAs from these WWTFs are established by existing permit limits that are below the current WQS. 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 TSS loads to Big Creek.

The elevated TSS levels in Big Creek are related to urban storm water (e.g., municipal separate storm sewer system [MS4]), WWTFs and, in particular, agricultural nonpoint sources. Nonpoint sources are assumed to be minimal at times that Big Creek is composed strictly of wastewater from the city of Hays. The LA grows proportionately as normal conditions occur, comprising 89% of non-wastewater load during normal flow conditions and generally restricted to central and eastern Ellis County. The LA and contributing areas grow as

wet weather ensues. At least 94% of the runoff driven loads are nonpoint source in nature and emanate throughout Ellis County up to the Trego County line. Two mechanisms dictate TSS concentrations in the lower reaches of Big Creek. The first factor is activities in proximity to the stream channel that predominate the low flow condition. This factor is a combination of point source and nonpoint source loadings and activities that potentially dislodge solids within the stream channel. The second mechanism is the erosion and transport of solids during wet weather from the watershed as a whole. Although bank sloughing and channel instability can contribute to this, Big Creek tends to be a flat stream with modest bank height. Overland runoff loads are the primary contributor to the rising trajectory of TSS concentrations at higher flows.

Cropland is the predominant land use in the watershed, comprising 62% of the total watershed area. Row crop production in the vicinity of Big Creek can significantly contribute TSS load to the surface water via overland flow. Sediment and suspended solids increase with runoff from the rural portions of the watershed.

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% 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. Zero WLAs are assigned to these confined animal feeding operations because all of these facilities should have no discharge to Big Creek. Based on Kansas Agricultural Statistics, most cattle are located in Gove and Ellis Counties as are the cattle in the confined feeding operations. There are livestock present in Russell County but no regulated facilities in the Big Creek drainage portion of the county. The grazing areas of these non-regulated feeding facilities may contribute the elevated TSS levels seen in the lower reaches of Big Creek.

Permitted concentrated animal feeding operation (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 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.

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.

Based on the 1990 census data, about 13 percent of the households in Ellis County, 39 percent of the households in Trego County, 37 percent of the households in Gove County and 19 percent of the households in Russell County utilize septic or other on-site systems. Because of their small flows, failing on-site septic systems would be a minor source of TSS loadings within the watershed and would not significantly contribute to the impairment.

Sediment and suspended solids are part of the landscape, in the soil profile as well as within the stream channels. There will always be extreme precipitation events that generate erosion from the land surface and transport solids into the stream channel as part of the aggregation/degradation process of fluvial geomorphology.

In the absence of an 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.

All of the known TSS 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.

LCs were given for each of the impaired segments, which were carefully addressed in this TMDL document. WLAs were set at the WQS for end-of-pipe for each NPDES facility. MS4 related WLA was also estimated based on its proportional area to the watershed. LAs were calculated as the difference between the TMDL (or LCs) and all of the WLAs. For this TMDL, the MOS is implicit (see MOS section for more information).

**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.

There are six NPDES permitted facilities potentially discharging to Big Creek. Two are dry batch, ready mix concrete plants permitted to discharge, but their operations collect any wash water for subsequent re-use or dust suppression. Domestic wastewater at both plants is directed toward the city of Hays wastewater collection and treatment system. Over the period from 2003 to 2009, neither has discharged. In addition to these, there are an additional eight non-discharging facilities that do not influence the TSS levels in Big Creek. The WLAs for these facilities are given in the following table.

NPDES Number	KS Permit Number	Facility Name	Design Flow (MGD)	WLA (lbs/day)
KS0036684	M-SH16-OO02	city of Hays WWTF	2.8	701.5
KS0094145	M-SH06-OO02	city of Ellis WWTF	0.3	74.5
KS0099309	M-SH38-OO02	city of Wakeeney WWTF	0.25	168.5
KS0096610	M-SH10-OO01	city of Gorham WWTF	0.0478	30.2
KSG110186	I-SH16-PR02	Ellis County Concrete	0.0	0.0
KSG110018	I-SH16-PR01	APAC-KS-Shears (Hays Plant #601)	0.0	0.0
KSJ000118	M-SH37-NO01	city of Victoria	0.0	0.0
KSJ000316	M-SH50-NO01	Munjor Improvement District	0.0	0.0
KSJ000116	I-SH16-NP05	APAC-KS-Shears (Hays Plant #921)	0.0	0.0
KSJ000311	M-SH38-NR02	KDOT -- Trego Co Rest Area	0.0	0.0
KSJ000331	M-SH12-NR02	KDOT -- Govc Co Rrst Area	0.0	0.0
KSJ000332	M-SH14-NO01	city of Grinnell	0.0	0.0
KSJ000329	M-SH12-NO01	city of Grainfield	0.0	0.0
KSJ000330	M-SH12-NO02	USD#292 Grainfield-Wheatland School	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 TSS loading. In the case of this TMDL, TSS increase at higher flows on the lower reaches of Big Creek receiving urban storm water during wet weather, while rural runoff increases the TSS levels from the remainder of the watershed. The following table lists the required WLA for this MS4 at various flow conditions.

MS4	Flow Condition (percent flow exceedance)	WLA (lbs/day)
city of Hays (KSR044008; M-SH16-SN01)	90	0.00
	75	51.36
	50	67.76
	25	101.55
	10	152.26

### 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  $LA = TMDL - WLA - MS4$ . The LAs for the three targeted segments, which include calculation of the loads from their associated tributaries, are given in the table below.

Segment ID	Flow Condition (percent flow exceedance)	LA (lbs/day)
Big Creek (1)	90	550.87
	75	1314.71
	50	4746.56
	25	9698.20
	10	16329.83
Big Creek (3)	90	550.87
	75	996.88
	50	3408.83
	25	6885.90
	10	10931.20
Big Creek (5)	90	186.57
	75	581.31
	50	2508.57
	25	5294.97
	10	8545.77

### 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 MOS, primarily relying on two conservative assumptions to be assured that future LAs and WLAs will not cause further excursions from the TSS criteria. First, WLAs are set based on current permit limits which do not cause the impairments by TSS seen in the lower reaches of Big Creek. Since current wasteload either do not reach the station where the impairment was noted or the permit limits are lower than the WQS or actual treatment produces, TSS levels in wastewater are far below permit limits. Second, the endpoint for this TMDL is 43 mg/L, which is significantly lower than the level of 50 mg/L. A stream that has a median TSS level of 50 mg/L is likely to support a rich diversity of aquatic life. This endpoint of 43 mg/L should fully ensure good living conditions on the lower reaches for the aquatic life.

### 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 (or high) flow conditions have been incorporated in the TMDL. This TMDL was developed using the LDC analysis. Five flow conditions, including the critical/high flows, were targeted and addressed in the LDC analysis.

This TMDL also has evaluated the seasonal TSS variability. Over 1990 to 2009 period, TSS shows a strong seasonal pattern with low levels from November through February, followed by spring (March to June) rises to a summer (July and August) peak and then an autumn (September to October) recession. Seasonal means for Sites

SC541 and SC540 are 19 and 24 mg/L, respectively, in winter; 49 and 100 mg/L in spring, 105 and 228 mg/L in summer and 65 and 85 mg/L in autumn. Moreover, median values are less distinct over September to February at Sites SC541 and SC540 (11 mg/L versus 19 mg/L) but remain divergent during spring and summer (53 mg/L versus 113 mg/L). The notable increase in TSS values and the difference between these two locations in the spring and summer is wholly a function of high flow conditions occurring during the March through August period.

#### **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/](http://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 Muujor) and SC541 (near Hays) and at the new station SC752 (near Russell). Based on the sampling data, the priority status of the 303(d) listing will be evaluated in 2014. The stream will be evaluated for possible delisting in 2020. Subsequent stream evaluation will be done at that time to assure that the conditions described by the narrative suspended solids criteria are attained.

#### **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 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 elevated TSS levels in Big Creek are primarily related to the WWTFs, urban storm water and in particular agricultural runoff. Several implementation activities that are required to establish the reasonable assurance for reduction in WLA and LA are provided in the TMDL as follows.

1. Implement and maintain conservation farming, including conservation tilling, contour farming and no-till farming to reduce runoff and suspended solids loads from Big Creek and its tributaries.
2. Improve riparian conditions along stream systems by installing grass and/or forest buffer strips to trap suspended solids, and reducing livestock activities within riparian areas to reduce stream bank erosion.
3. Install pasture management practice, including proper stock density, to reduce soil erosion and storm runoff.
4. Minimize road and bridge construction impacts on streams.
5. Establish urban and construction storm water management practices to abate sediment loading in

Hays.

6. **Maintain permit limits for TSS in federal and state permits, inspect permitted facilities and monitor wastewater discharges to assure compliance.**