TOTAL SUSPENDEND SOLIDS (TSS) TOTAL MAXIMUM DAILY LOAD AND WATER QUALITY IMPROVEMENT PLAN FOR THE BIG SIOUX RIVER SEGMENTS 5 AND 6 BROOKINGS COUNTY, SOUTH DAKOTA

South Dakota Department of Agriculture and Natural Resources

Division of Resource Conservation and Forestry

Watershed Protection Program

2024

Table of Contents

List of Acronyms

Acronym	Definition
AFO	Animal Feeding Operation
ARSD	Administrative Rules of South Dakota
BMP	Best Management Practice
CAFO	Concentrated Animal Feeding Operation
cfs	Cubic Feet Per Second
CFU	Colony Forming Unit
CWA	Clean Water Act
DMR	Discharge Monitoring Report
SDDANR	South Dakota Department of Agriculture & Natural Resources
EDWDD	East Dakota Water Development District
EPA	Environmental Protection Agency (U.S.)
GM	Geometric Mean
HIT	High Impact Targeting Model
HUC	Hydrologic Unit Code
IR	Integrated Report (South Dakota's Report for Surface Water Quality)
LA	Load Allocation
LDC	Load Duration Curve
mL	Milliliter
MOS	Margin of Safety
MS4	Municipal Separate Storm Sewer System
NLCD	National Land Cover Dataset
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
RGA	Rapid Geomorphic Assessment
SDCL	South Dakota Codified Law
SSM	Single Sample Maximum
SWMP	Stormwater Management Project
SWMM	Stormwater Management Model
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
USGS	United States Geological Survey
WLA	Wasteload Allocation
WPP	Watershed Protection Program (South Dakota)
WQM	Water Quality Monitoring
WWTP	Wastewater Treatment Plant
WWTF	Wastewater Treatment Facility

Big Sioux Segment 5 Total Maximum Daily Load Summary

Waterbody Type: River/Stream

Reach Number: SD-BS-R-BIG_SIOUX_05

303(d) Listing Parameter: Total Suspended Solids (TSS)

Designated Uses of Concern: Warmwater Semipermanent Fish Life

Location: Near Volga, SD to Brookings, SD

Size of Impaired Waterbody: SD-BS-R-BIG_SIOUX_05 – Approximately 10.07 miles

Associated HUCs:

Name	HUC	Associated Acres
Upper Sixmile Creek	101702020601	19,045
Lower Sixmile Creek	101702020602	28,119
Upper North Deer Creek	101702020701	32,297
Saint Pauls Church	101702020702	24,239
Middle North Deer Creek	101702020703	14,620
Lower North Deer Creek	101702020704	8,971
Medary Creek – Big Sioux River	101702021110 - Partial HUC	8,513
Lake Sinai	101702021110	19,003

Indicator(s): Concentration of Total Suspended Solids

Analytical Approach: Load Duration Curve Framework

TMDL Priority Ranking: Priority 1 (2024 IR)

Target (Water Quality Criteria): Total Suspended Solids - Maximum daily concentration of ≤ 158 mg/L and a geometric mean of ≤ 90 mg/L for a thirty-day average of at least three consecutive grab or composite samples taken on separate weeks.

Warmwater Semipermanent Fish Life Propagation TSS TMDL	BIG SIOUX 05 TMDL Table				
	High Flows	Moist Conditions	Mid-Range Conditions	Dry Conditions	Low Flows
Flow Rate	≤ 10.0%	10 - 40.0%	40.0 - 60.0%	60.0 - 90.0%	≥ 90.0%
WLA - City of Volga (Ton/day)	6.00E-02	6.00E-02	6.00E-02	6.00E-02	6.00E-02
WLA - MS4	3.02E+01	6.32E+00	1.27E+00	6.10E-01	1.26E-01
LA	1.01E+03	2.11E+02	4.25E+01	2.03E+01	4.19E+00
10% Explicit MOS	1.15E+02	2.41E+01	4.87E+00	2.34E+00	4.87E-01
TMDL @ 90 mg/L	1.15E+03	2.41E+02	4.87E+01	2.34E+01	4.87E+00
Current Load	1.88E+03	5.78E+02	1.27E+02	4.31E+01	5.04E+00
Load Reduction	39%	58%	62%	46%	4%

Big Sioux Segment 6 Total Maximum Daily Load Summary

Waterbody Type: River/Stream

Reach Number: SD-BS-R-BIG_SIOUX_06

303(d) Listing Parameter: Total Suspended Solids (TSS)

Designated Uses of Concern: Warmwater Semipermanent Fish Life

Location: Near Brookings, SD to Brookings/Moody County Line

Size of Impaired Waterbody: SD-BS-R-BIG_SIOUX_06– Approximately 8.12 miles

Associated HUCs:

Name	HUC	Associated Acres
Medary Creek – Big Sioux River	101702021110-Partial HUC	14,144
Lake Badus – Battle Creek	101702020801	33,363
Lake Madison Church-Battle Creek	101702020802	26,037
Mud Lake	101702020803	19,388
Pelican Lake-Battle Creek	101702020804	25,895
Lake Campbell-Battle Creek	101702020805	13,516
Molumby Slough	101702020806	24,485
Lake Campbell Outlet	101702020807	18,506
Fountain Cemetery	101702021109	19,281

Indicator(s): Concentration of Total Suspended Solids

Analytical Approach: Load Duration Curve Framework

TMDL Priority Ranking: Priority 1 (2024 IR)

Target (Water Quality Criteria): Total Suspended Solids - Maximum daily concentration of ≤ 158 mg/L and a geometric mean of ≤ 90 mg/L for a thirty-day average of at least three consecutive grab or composite samples taken on separate weeks.

Warmwater Semipermanent Fish Life Propagation TSS TMDL	BIG SIOUX 06 TMDL Table				
	High Flows	Moist Conditions	Mid-Range Conditions	Dry Conditions	Low Flows
Flow Rate	≤ 10.0%	10 - 40.0%	40.0 - 60.0%	60.0 - 90.0%	≥ 90.0%
WLA - City of Brookings WWTF	8.80E-01	8.80E-01	8.80E-01	8.80E-01	8.80E-01
WLA - MS4	2.54E+01	5.31E+00	1.05E+00	4.97E-01	8.88E-02
LA	1.18E+03	2.47E+02	4.91E+01	2.31E+01	4.14E+00
10% Explicit MOS	1.35E+02	2.81E+01	5.67E+00	2.72E+00	5.67E-01
TMDL @ 90 mg/L	1.35E+03	2.81E+02	5.67E+01	2.72E+01	5.67E+00
Current Load	1.19E+03	5.93E+02	1.42E+02	4.83E+01	7.57E+00
Load Reduction	0%	53%	60%	44%	25%

1.0 Document Summary

The Environmental Protection Agency (EPA) delegates authority to the South Dakota Department of Agriculture and Natural Resources (SD DANR) in accordance with Section 303(d) of the federal Clean Water Act (CWA), to develop impaired waters lists and Total Maximum Daily Load (TMDL) reports. The intent of this document is to clearly identify the components of the TMDL process and facilitate EPA review and approval. This TMDL document addresses the TSS impairment for segments SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 of the Big Sioux River in the Big Sioux River Basin. SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 was considered high priority for TMDL development in the 2016, 2018, 2020, 2022, and 2024 Integrated Report for Surface Water Quality Assessment (IR) and has been on the TMDL Vision Priority list since 2014. The segments SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 have been listed as non-supporting for warm water semipermanent fish life use due to total suspended solids violations and have subsequently been included on the biennial §303(d) lists since 2004.

2.0 Watershed Characteristics

SD-BS-R-BIG_SIOUX_05 is a ten-mile segment that extends near Volga, South Dakota to near Brookings, South Dakota. The SD-BS-R-BIG_SIOUX_05 watershed is approximately 154,807 acres. North Deer Creek and Six Mile Creek are the main tributaries of SD-BS-R-BIG_SIOUX_05 (***Figure 1)***.

SD-BS-R-BIG_SIOUX_06 extends from Brookings, South Dakota to the Brookings/Moody County line. SD-BS-R-BIG_SIOUX_06 watershed and drainage area is approximately 194,615 acres. The Lake Campbell outlet is the main tributary to this segment.

2.1 Drainage Area and Precipitation

The totality of the Big Sioux River Basin drains approximately 8,282 square miles between eastern South Dakota, southwestern Minnesota, and northwestern Iowa. The average annual discharge of the Big Sioux River is approximately 246 cubic feet per second, and it is estimated, on average, to exceed bank full stage every 2-3 years (SD DANR, 2016). Precipitation largely occurs in the spring and summer months with about 23 inches a year on average (NOAA, 2023).

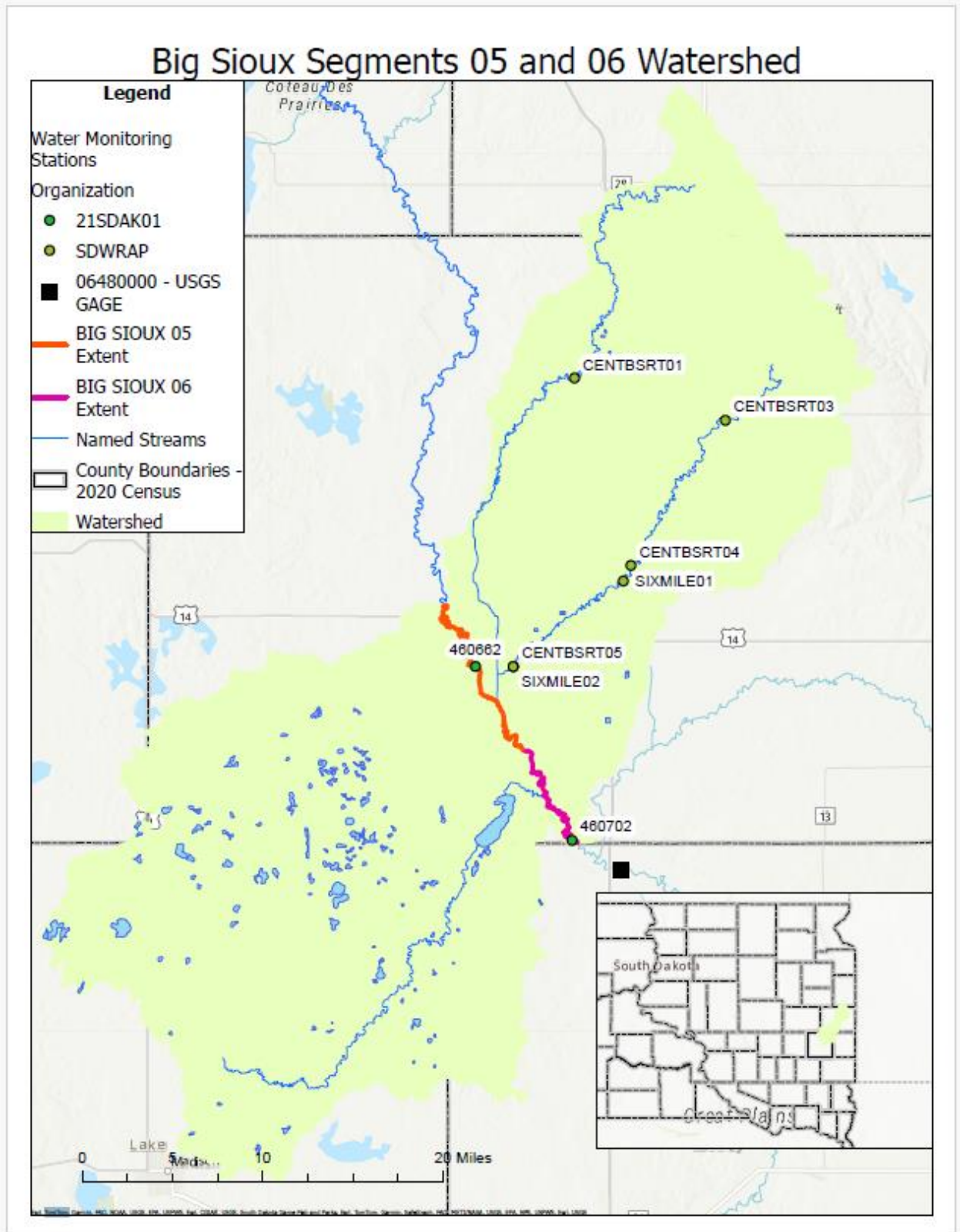

Figure 1 - SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 Watershed

2.2 Soil Type

The SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 watershed are considered part of the Northern Glaciated Plains Ecoregion. This ecoregion is characterized by a flat, gently rolling landscape composed of glacial till. There are high concentrations of temporary and seasonal prairie pothole wetlands scattered across the landscape. The river itself sits atop a shallow alluvial layer. The watershed is made up of productive mollisols along with silty clay loams and clay loams (***Figure 2)***. Several loams found in this watershed include Poinsett-Buse Waubay in the southwest, Barnes clay loams and Kranzburg-Brookings silty loams in the northeast. The soil erodibility factor is quantified as the susceptibility of soil particles to detach and move with the interference of water. The southern-most end of the watershed is comprised of more frequent erodible soils (***Figure 3***). Imagery from the USA Soils Map Units layer derived from the SSURGO database was used to determine soil type, while the USA SSURGO – Erodibility Factor layer was used to determine soil erodibility in the SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 watershed.

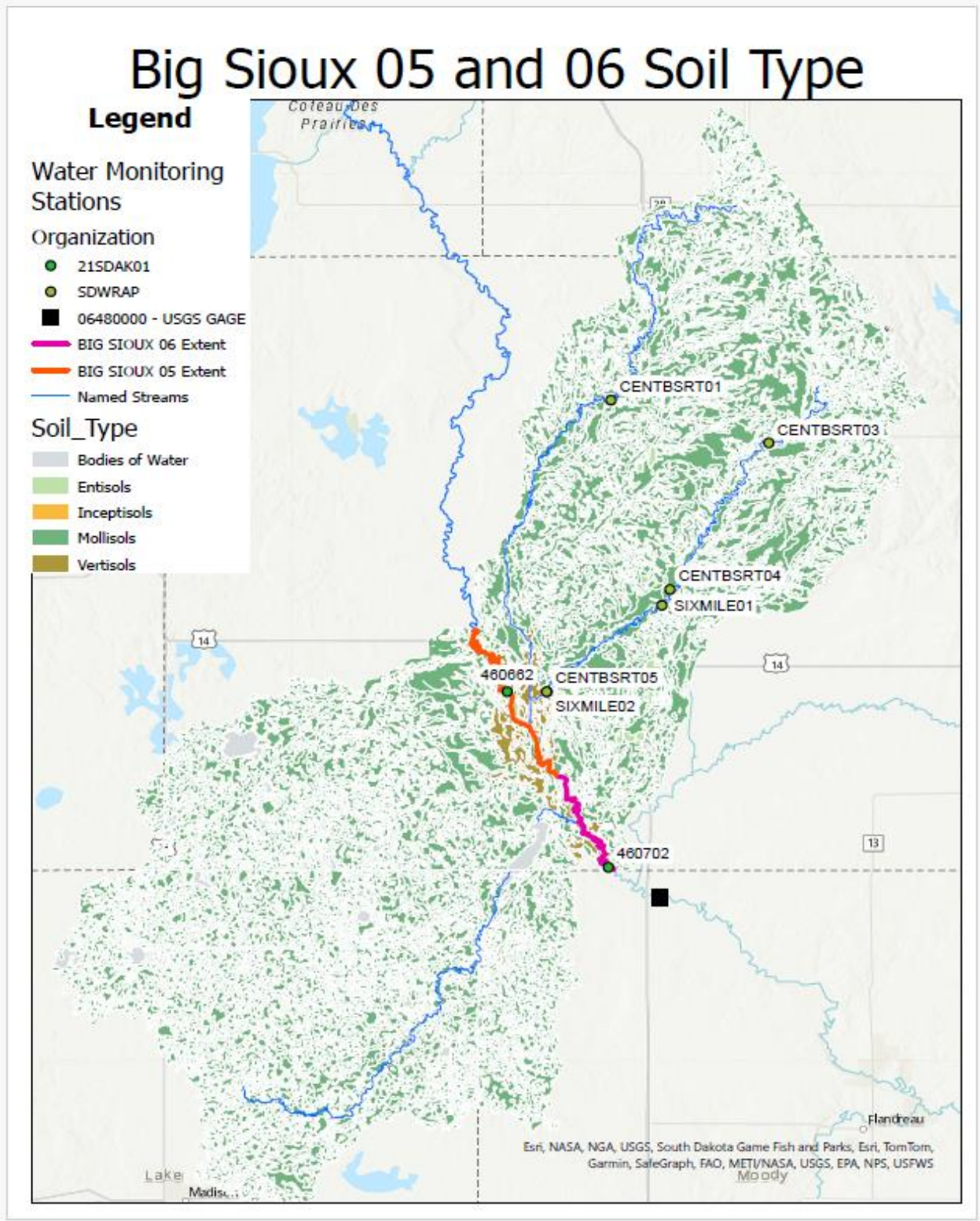

Figure 2 - Big Sioux Segments 05 and 06 Soil Type

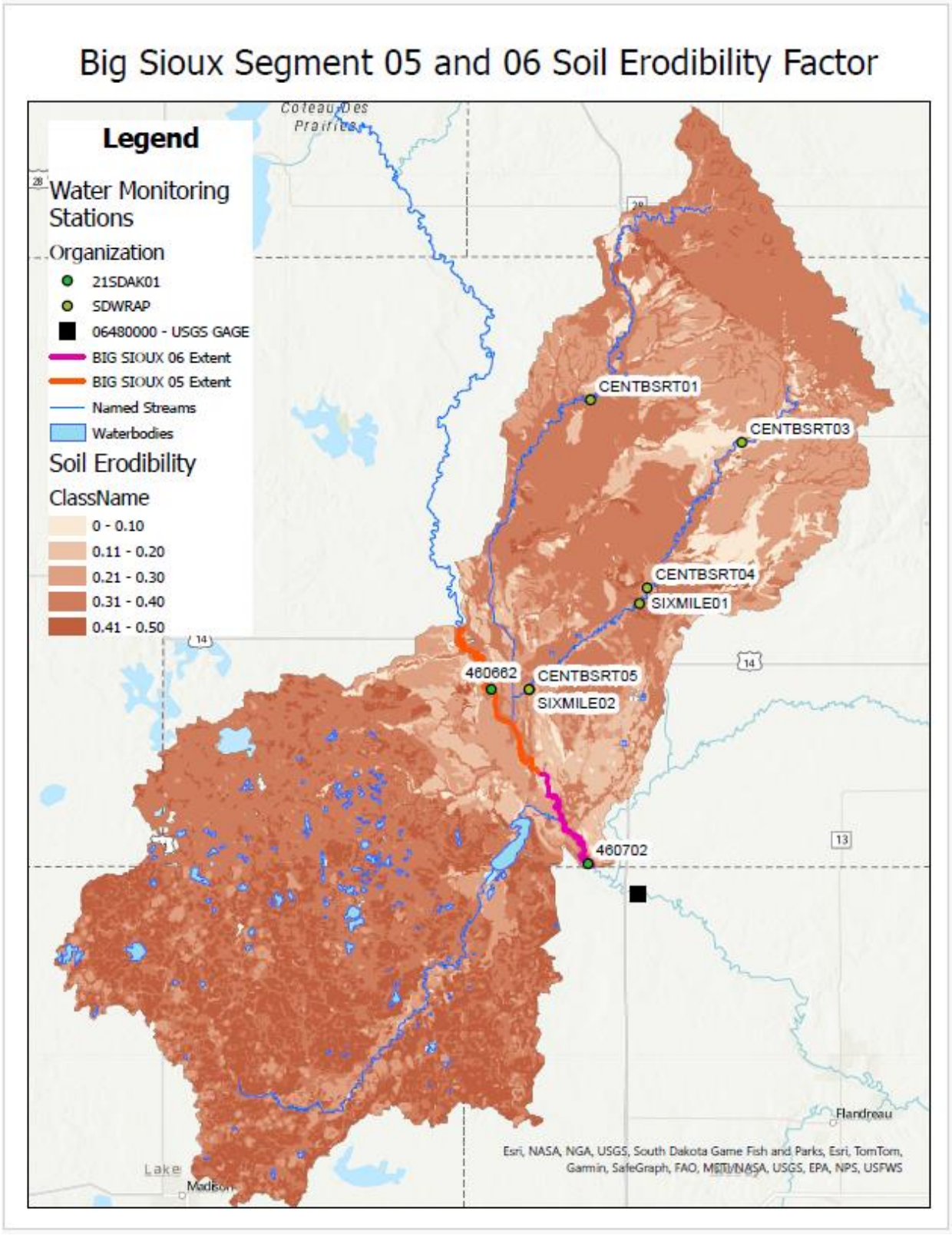

Figure 3 - Soil Erodibility Potential in Big Sioux Segment 05 and 06 Watershed

2.3 Demographics

Brookings County has an estimated population of 34,375 individuals according to the 2020 U.S Census Bureau. Towns in the watershed include Brookings (23,377), White (537), Toronto (196), Sinai (99) and Nunda (46). Deuel County has approximately 4,346 people, Lake and Moody Counties had 12,488 and 6,525 people, respectively. Using an area-based weighting and accounting for cities, an estimated 26,386 people live in the watershed with 755 rural folks and 25,631 people associated with towns.

2.4 Land Cover

The National Land Cover Dataset (NLCD) was used to compare changes in land use from 2006 to 2021 and are shown in ***Table 1***. The watershed is used extensively for agriculture, particularly for the cultivation of crops, which comprised 67.5% of the land use in 2021. Developed areas including, open space, low intensity, medium intensity, and high intensity areas make up approximately 5% of the total land use area in 2021.

Concentrated Animal Feeding Operations (CAFOs) are also found throughout the watershed. As of 2024, there are eight CAFOs within the SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 watershed. Most grazing takes place in the remaining riparian areas adjacent to streams. Livestock grazing pressure can result in the deterioration of riparian areas along channels and streambanks.

Tallgrass prairie with big and little bluestem, switchgrass and Indian grass are the native species, however little intact tallgrass prairie remains. A representation of the current land use is shown in ***Figure 4***. For more information and definitions regarding the land cover categories represented in the watershed visit the Esri USA NLCD Land Cover Database[1].

Table 1 - Land Cover in Big Sioux River Segment 05 and 06 According to National Land Cover Dataset

	NLCD 2006	NLCD 2021
Cultivated Crops	67.1%	67.5%
Hay/Pasture	13.0%	11.5%
Emergent Herbaceous Wetlands	5.5%	5.4%
Herbaceous	5.5%	5.4%
Developed, Open Space	4.2%	3.9%
Open Water	2.2%	2.4%
Developed, Low Intensity	1.0%	1.1%
Developed, Medium Intensity	< 1%	< 1%
Deciduous Forest	< 1%	< 1%
Developed, High Intensity	< 1%	< 1%
Barren Land	< 1%	< 1%
Mixed Forest	< 1%	< 1%
Woody Wetlands	< 1%	< 1%
Shrub/Scrub	< 1%	< 1%
Evergreen Forest	< 1%	< 1%

[1] Esri NLCD Land Cover Description

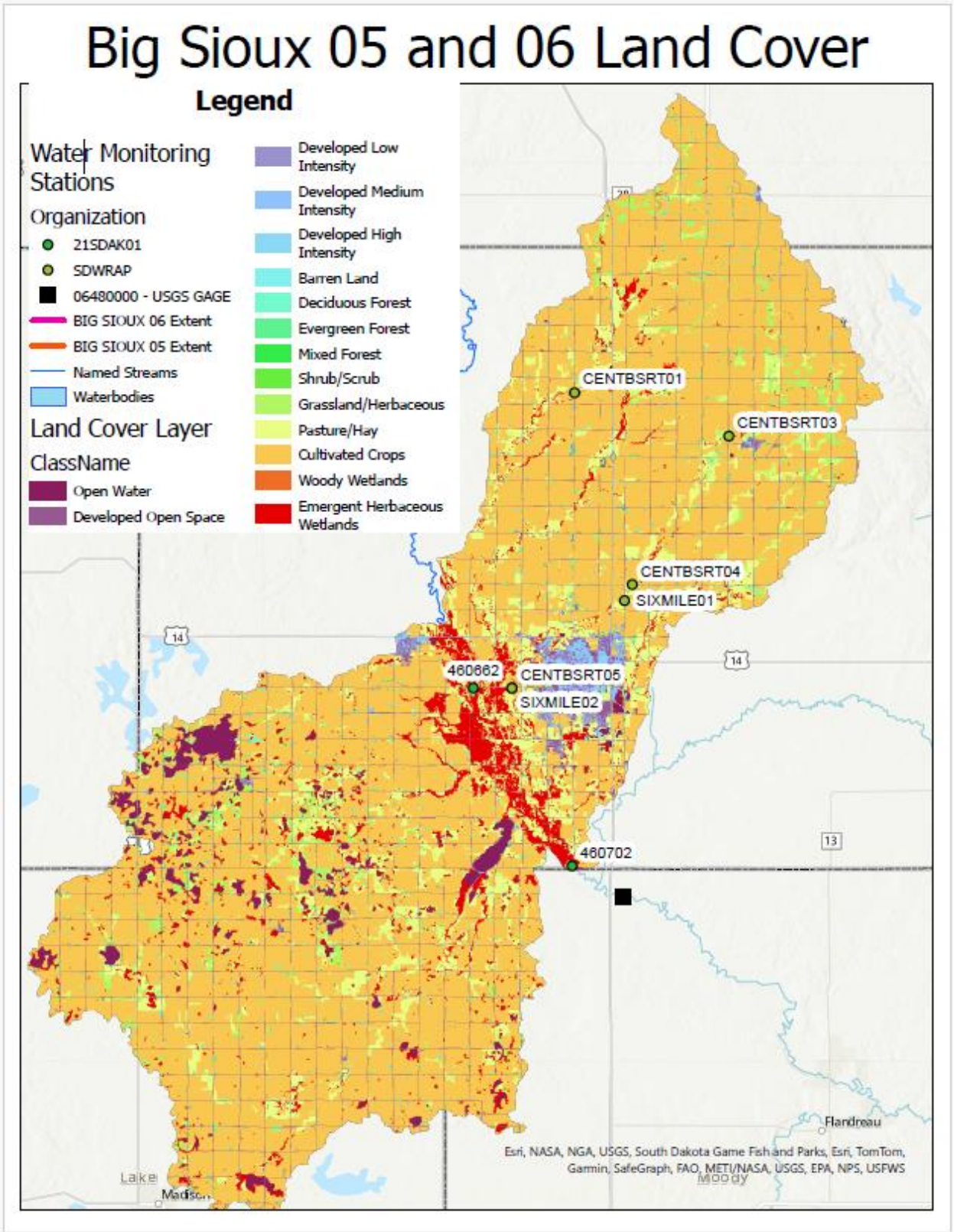

Figure 4 - Land Cover Map in Big Sioux Segments 05 and 06 Watershed

3.0 South Dakota Water Quality Standards

Water quality standards are comprised of three main components as defined in the Federal Clean Water Act (33 U.S.C. §1251 et seq.) and Administrative Rules of South Dakota (ARSD) can be located here: Chapter 74:51:01

- Beneficial Uses: Functions or activities that reflect waterbody management goals
- Criteria: Numeric concentrations or narrative statements that represent the level of water quality required to support beneficial uses
- Antidegradation: Additional policies that protect high quality waters

3.1 Beneficial Uses

The waterbodies in South Dakota are assigned beneficial uses. A list of beneficial uses for South Dakota waters can be found here: Administrative Rule 74:51 South Dakota Legislature

1) Domestic water supply
2) Coldwater permanent fish life propagation
3) Coldwater marginal fish life propagation
4) Warmwater permanent fish propagation
5) Warmwater semipermanent fish life propagation
6) Warmwater marginal fish life propagation
7) Immersion recreation
8) Limited contact recreation
9) Fish and wildlife propagation, recreation, and stock watering
10) Irrigation
11) Commerce and industry

All waters (both lakes and streams) in South Dakota are designated the use of fish and wildlife propagation, recreation, and stock watering (9). All streams are designated the uses of (9) and (10) irrigation, unless stated otherwise in the Administration Rules of South Dakota (ARSD). A beneficial use attainability assessment is conducted on additional waterbodies if designated uses are not included in accordance with the Clean Water Act (CWA).

SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 have been assigned the following beneficial use designations (5) warmwater semipermanent fish life propagation, (8) limited contact recreation, (9) fish and wildlife propagation, recreation, and stock watering, and (10) irrigation waters.

The Big Sioux River Segment 07 identified as SD-BS-R-BIG_SIOUX_07 is the downstream water that receives flow from SD-BS-R-BIG_SIOUX_06 and has been assigned the beneficial uses of (1) domestic water supply (5) warmwater semipermanent fish life propagation, (8) limited contact recreation, (9) fish and wildlife propagation, recreation, and stock watering, and (10) irrigation. SD-BS-R-BIG_SIOUX_07 is impaired for TSS and mercury but there are EPA approved TMDLs for both pollutants.

3.2 Water Quality Criteria

The water quality standard criteria must be met to protect and support the beneficial uses designated for segments SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 (***Table 2***). When multiple uses establish criteria for the same parameter, the most stringent criterion is used for regulatory purposes.

Table 2 - South Dakota Water Quality Criteria for Big Sioux Segments 5 and 6

Parameter	Criteria	Beneficial Use
Alkalinity ($CaCO_3$)	≤ 750 mg/L(1)	Fish and wildlife propagation, recreation, and stock watering
	≤ 1313 mg/L(2)	
Total dissolved solids	≤ 2,500 mg/L(1)	
	≤ 4,375 mg/L(2)	
Conductivity at 25°C	≤ 4,000 micromhos/cm(1)	
	≤ 7,000 micromhos/cm(2)	
Nitrates as N	≤ 50 mg/L	
	≤ 88 mg/L	
pH	≥ 6.0 - ≤ 9.5 units	
Total petroleum hydrocarbon	≤ 10 mg/L	
Oil and grease	≤ 10 mg/L	
Conductivity at 25°C	≤ 2,500 micromhos/cm(1)	Irrigation
	≤ 4,375 micromhos/cm(2)	
Sodium adsorption ratio	≤ 10 ratio	
Total ammonia nitrogen as N	Equal to or less than the result from Equation 3 in Appendix A(1)	Warmwater semipermanent fish life propagation waters
	Equal to or less than the result from Equation 2 in Appendix A(2)	
Dissolved Oxygen(3)	≥ 5.0 mg/L	
Undissociated hydrogen sulfide(2)	≤ 0.002 mg/L	
pH (standard units)	≥ 6.5 - ≤ 9.0 units	
Total Suspended Solids	≤ 90 mg/L(1)	
	≤ 158 mg/L(2)	
Temperature	≤ 90 °F	
Dissolved Oxygen(3)	≥ 5.0 (2)	Limited Contact Recreation
Escherichia coli (May 1 – September 30)	≤ 630 cfu/100 mL(4)	
	≤ 1178 cfu/100 mL(2)	
Microcystin	8 µg/L	
Cylindrospermopsin	15 µg/L(5)	

1) 30-day average as defined in ARSD 74:51:01:01(60); (2) daily maximum; (3) DO as measured anywhere in the water column of a non-stratified waterbody, or in the epilimnion of a stratified waterbody; (4) Geometric mean as defined in ARSD 74:51:01:01(24) and 74:51:01:50-51; (5) Not to be exceeded in more than three 10 day assessment periods over the course of the recreation season.

3.3 Total Suspended Solids Water Quality Criteria

South Dakota has adopted numeric TSS criteria for the protection of the (2) coldwater permanent fish life propagation, (3) coldwater marginal fish life propagation, (4) warmwater permanent fish life propagation, (5) warmwater semipermanent fish life propagation, (6) and warmwater marginal fish life propagation uses. Waters designated fish life propagation uses are to be maintained suitable for the propagation of fish life in order to protect aquatic life and the productivity of fisheries.

The South Dakota TSS criteria for the warmwater semipermanent fish life propagation beneficial use requires that 1) no single sample exceed 158 mg/L and 2) during a 30-day period, the mean of a minimum of 3 samples collected during separate weeks must not exceed 90 mg/L (ARSD 74:51:01:48). The numeric TSS criteria applicable to SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 are associated with the warmwater semipermanent fish life propagation values listed in ***Table 2***.

TMDLs must be protective of downstream uses and associated water quality criteria. SD-BS-R-BIG_SIOUX_06 flows into the Big Sioux River Segment 7 (SD-BS-R-BIG_SIOUX_07), which has the same beneficial uses as SD-BS-R-BIG_SIOUX_06, except for an additional (1) domestic water supply beneficial use. SD DANR's approved IR indicates on pg. 12 that TSS criteria is not associated with the (1) domestic water supply beneficial use. Therefore, it is not necessary for SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 to adopt SD-BS-R-BIG_SIOUX_07's additional beneficial use criteria and the TMDL will still be protective of downstream water quality standards.

3.4 Numeric TMDL Targets

TMDLs are required to identify a numeric target to measure whether the applicable water quality standard is attained. A maximum allowable load, or TMDL, is ultimately calculated by multiplying this target with a flow value and a unit conversion factor. Generally, the pollutant causing the impairment and the parameter expressed as a numeric water quality criterion are the same. In these cases, selecting a TMDL target is as simple as applying the numeric criteria. Occasionally, an impairment is caused by narrative water quality criteria violations or by parameters that cannot be easily expressed as a load. When this occurs, the narrative criteria must be translated into a numeric TMDL target (e.g., nuisance aquatic life translated into a total phosphorus target) or a surrogate target established (e.g., a pH cause addressed through a total nitrogen target) and a demonstration should show how the chosen target is protective of water quality standards.

As seen from ***Table 2*** there is only one numeric TSS criteria for TMDL target consideration. When multiple numeric criteria exist for a single parameter, the most stringent criterion is selected as the TMDL target, if applicable. The numeric TMDL target for TSS for SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 is 90 mg/L, which is based on the 30-day mean threshold for TSS. This criterion is more stringent than the single sample maximum for TSS of 158 mg/L.

4.0 Antidegradation

This TMDL document is consistent with South Dakota antidegradation policies (ARSD 74:51:01:34) because it provides recommendations and establishes pollutant limits at water quality levels necessary to meet criteria and fully support existing beneficial uses.

5.0 Assessment Methods

Assessment methods document the decision-making process used to define whether water quality standards are met. SD DANR evaluates monitoring data following these established procedures to determine if: 1) one or more beneficial use is not supported, 2) the waterbody is impaired, and 3) it should be placed on the next 303(d) list. Waterbodies impaired by pollutants require TMDLs and these assessment methods are commonly used again in the process sometime after TMDLs have been established and restoration efforts have been implemented. In select cases, attainment is judged instead by comparing current conditions to TMDL loading limits. For example, when certain characteristics of the pollutant (e.g., bioaccumulative) or waterbody (e.g., a reservoir filling with sediment) prioritize loading concerns. The table below presents South Dakota's assessment method and describes what constitutes a minimum sample size and how an impairment decision is made ***(Table 3)***.

Integrated Report Assessment Methods		
Description	**Minimum Sample Size**	**Impairment Determination Approach**
FOR CONVENTIONAL PARAMETERS: • TSS • *E. coli* • pH • Temperature • Dissolved Oxygen	STREAMS: Minimum of 20 samples (collected on separate days) for any one parameter are required within a waterbody reach. Minimum of 10 chronic (calculated) results are required for chronic criteria (30-day averages and geomeans). LAKES: Reference the lake listing methodology starting on page 19 of the 2024 IR.	STREAMS: >10% exceedance for daily maximum criteria (acute or >10% exceedance for 30-day average criteria OR when overwhelming evidence suggests nonsupport/support). LAKES: Reference the lake listing methodology staring on page 19 of the 2024 IR.

Table 3 - Assessment Methodology

The assessment method mentions chronic and acute criteria. Although these terms do not directly relate to TSS criteria for reasons previously discussed, the assessment method is organized together with other conventional parameters in the IR to show that a consistent approach is applied to many pollutants. In this limited definition, chronic refers to the 30-day geometric mean (GM) and acute refers to the single sample maximum (SSM) TSS criteria. Different assessment methods have been established for toxic parameters and mercury in fish tissue.

6.0 Source Assessment and Allocations

6.1 Point Sources

Point sources are the direct discharges of pollutants into bodies of water. Surface water discharges, stormwater and any permitted Concentrated Animal Feeding Operation (CAFO) that discharge directly to a waterbody would be considered point sources. There are several documented point sources within the SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 watersheds. These sources include nine National Pollutant Discharge Elimination System (NPDES) permitted facilities and one Municipal Separate Storm Sewer System (MS4) facility that may directly contribute sediment to the impaired segments of the Big Sioux River. These potential sources of TSS are documented here to provide a watershed scale account of each entity's operational characteristics (discharge permits etc.), potential impact, and Waste Load Allocation (WLA) consideration for the impaired segments of the Big Sioux River.

The permitted NPDES facilities within the SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 watersheds are represented below (***Table 4***).

Table 4 - NPDES Facilities in the Big Sioux River Segment 5 and 6

Facility	Permit number	HUC Location	HUC number	Discharges to	BS5/6	WLA (ton/day)
City of Volga WWTF	SD0021920	Lake Sinai	101702021108	unnamed trib to BS	5	0.06
City of Volga WTP	SDG860029	Lake Sinai	101702021108	unnamed trib to BS	5	0
Soybean Processers	SDP000090	Lake Sinai	101702021108	Volga POTW	5	0
Prairie Aquatech Manufacturing	SDP000133	Lake Sinai	101702021108	Volga POTW	5	0
City of White	SD0021636	Upper Six Mile Creek	101702020601	unnamed trib to Six Mile	5	0
Dakotah Bank	SD0028568	Lower Six Mile Creek	101702020602	MS4 to SixMile	5	0
SDSU	SD0026832	Lower Six Mile Creek	101702020602	unnamed trib to Six Mile	5	0
City of Brookings WWTP	SD0023388	Medary creek-Big Sioux	101702021110	BS6	6	0.88
Town of Sinai	SDG820974	Molumby Slough	101702020806	No discharge	6	0
City of Brookings MS4	SDR41A003	Lower Six Mile Creek	101702020602	MS4 to Six Mile	5 and 6	MS4

6.1.1 Construction Stormwater Permits

Construction activities have the potential to produce pollutants that may contaminate stormwater runoff. Currently there are several non-major construction permits that are ongoing in the watershed. The status of these construction projects is currently unknown, however they are considered to be active by SD DANR until the permitted party opts to close the permit. All the permits authorize discharge of stormwater, but do not authorize discharge if the discharge will cause or have the reasonable potential to cause or contribute to violations of surface water quality. Stormwater construction activities must have coverage and comply with South Dakota's *General Permit Authorizing Stormwater Discharges Associated with Construction Activities*[2] ensuring that discharges are minimal. The TMDL assumes their TSS contribution will be minimal, and unless found otherwise, no additional permit conditions are required by this TMDL. Future permits will remain under the same assumption, unless otherwise established. Construction stormwater permittees can be found in ***Appendix B***. A WLA of zero was assigned to each construction stormwater permittee in the SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 TMDL.

[2] https://danr.sd.gov/OfficeOfWater/SurfaceWaterQuality/docs/DANR_ConstructionGeneralPermit2023.pdf

6.1.2 Wastewater Treatment Facilities

City of Volga WWTF (NPDES Permit #SD0021920)

The City of Volga operates a wastewater treatment facility in Brookings County, South Dakota (Latitude 44.320278°, Longitude -96.893972°). Primary treatment includes two concrete aeration basins, a 21-acre pond system and a 15-acre constructed wetland. The outflow from the WWTF is discharged to an unnamed tributary of the Big Sioux River. Wastewater travels approximately 1/8 mile until the tributary's confluence with the Big Sioux River. Discharge is continuous and controlled with an adjustable slide gate followed by a 6" Parshall flume. The facility's average design flow is 0.887 million gallons per day (MGD), with a peak design flow of 1.183 MGD. Upgrades to the facility in 2018 include converting the discharge to continuous.

The city collects wastewater from Soybean Processors (SDP000090) and Prairie Aquatech Manufacturing (SDP000133) which are both permitted under SD DANR's Industrial Pretreatment Program.

The WLA for this facility was calculated by using the facility's daily max TSS limit (45 mg/L) and multiplying it by the 80th percentile daily max flow, 0.310 MGD, and then by a conversion factor (4.172 x 10^{-3}). This facility was assigned a WLA of 0.06 tons/day for the SD-BS-R-BIG_SIOUX_05 TMDL.

City of White WWTF (NPDES Permit #SD0021636)

The City of White is about 11 miles northeast of Brookings in the upper part of the watershed. The City's wastewater treatment facility is located one mile southwest of White, SD. Wastewater is discharged to an unnamed tributary about 1.5 miles upstream from the confluence of Six Mile Creek. The facility is a gravity flow collection system with a three-cell stabilization pond. This system serves 537 people (2020) and has a peak flow design of 27,900 GPD. Discharge from the facility occurs intermittently generally for a week or two in the spring and fall. TSS is not permitted to exceed 30 mg/L for the 30-day average or 45 mg/L within 7 days. The facility used to discharge annually, now it is more like monthly since late 2014. Due to the distance from the discharge to Six Mile, the City of White was assigned a WLA of zero for the SD-BS-R-BIG_SIOUX_05 TMDL.

Town of Sinai WWTF (NPDES Permit #SDG820974)

The Town of Sinai, located more than 10 miles west of the Big Sioux River, has a minor wastewater treatment facility with no discharge permitted. During the current permit cycle (12/1/2018 – present), the facility reported two emergency discharges. Emergency discharges are a discharge from the treatment or containment system through a release structure or over/through retention dikes or walls. An emergency discharge is an enforceable violation of the permit unless it is an allowable bypass that does not cause effluent limitations to be exceeded, an anticipated bypass approved by the Secretary, or an unanticipated bypass allowed under the permit (Section 3.1 – Prohibition of Bypass, Emergency Discharges, and SSOs). If the facility were to discharge under emergency conditions, the wastewater would travel 450 feet to an unnamed wetland. In addition, daily TSS monitoring is required during overflows and emergency discharges.

Considering the distance from the TMDL waterbodies and the infrequent discharges, the WLA for this facility is therefore zero.

6.1.3 Non-Wastewater Treatment Facilities

City of Volga WTP (NPDES Permit #SDG860029)

The City of Volga's drinking water treatment plant and distribution facility operates five ground water wells and a water tower. This water is discharged through the storm sewer to an unnamed tributary 4 miles away from the Big Sioux. The drinking water treatment and distribution facilities are not sources of TSS to the TMDL waterbodies. Although no discharge has ever been reported, the facility has BMPs in place to settle out TSS from raw water permitted to discharge from outfall DW1. The DW2 outfall discharges only fully treated drinking water with very low TSS. Because of the distance from the Big Sioux River and the low TSS concentrations, the City of Volga's WLA is denoted as zero for the SD-BS-R-BIG_SIOUX_05 TMDL.

Dacotah Bank (NPDES Permit #SD0028568)

Dacotah Bank operates a sump discharge located at 1441 6th Street in the Southwest ¼ of Section 24, Township 110 North, Range 50 West, in Brookings County, South Dakota (Latitude 44.311389°, Longitude -96.781667°, Navigational Quality GPS). Any discharge from this facility will enter the Brookings municipal storm sewer system (MS4) which is assigned a WLA in this TMDL. As a result, Dacotah Bank was assigned a WLA of zero for the SD-BS-R-BIG_SIOUX_05 TMDL.

SDSU Swimming Pool (NPDES Permit #SD0026832)

SDSU's wastewater discharge permit for the campus swimming pool does not allow discharge of TSS. As a result, SDSU Swimming Pool was assigned a WLA of zero for the SD-BS-R-BIG_SIOUX_05 TMDL.

SD Soybean Processors (NPDES Permit #SDP000090)

SD Soybean Processors operate a soybean processing plant that continuously discharges to the City of Volga's WWTF and so are included as a part of the City of Volga's WLA. The average discharge is 128,000 gal/day. TSS is limited to 100 lbs/day and flow rate is limited to .20 MGD for a 30-day average. SD Soybean Processors submits Discharge Monitoring Reports (DMRs) as required under their current permit. SD Soybean Processor's WLA is denoted as zero for the SD-BS-R-BIG_SIOUX_05 TMDL.

Prairie Aquatech (NPDES Permit #SDP000133)

Prairie Aquatech Manufacturing LLC operates an animal health and nutrition facility in the city of Volga. It produces dry protein and liquid molasses from soybean meal. This facility continuously discharges to the City of Volga's WWTF where the wastewater is treated and discharged to the Big Sioux River via an unnamed tributary. Its effluent limits include 40 lbs/day for TSS 30-day average. The flow rate is limited to .11 MGD. Prairie Aquatech's WLA is denoted as zero for the SD-BS-R-BIG_SIOUX_05 TMDL.

City of Brookings Municipal Utilities WWTP (NPDES Permit #SD0023388)

The City of Brookings operates a wastewater treatment plant two miles south of the city, serving 23,377 people (2020). Various industries that discharge to the WWTP include 3M, Star Circuits, Hub City, Excel Storage and Twin City Fan. Industrial discharges make up about 3% of the total facility flow. The facility was built in 1980, with the most recent upgrade occurring in 2016. The facility has a peak flow design of 15 MGD. Pretreatment, primary clarification, bio-filtration, aeration, final clarification, tertiary filtration, disinfection, sludge digestion and land application on sludge are all part of the treatment process.

TSS is limited to a 30-day average of 30 mg/L, 7-day average of 45 mg/L. The WWTP discharges regularly, with monthly discharges in 2019. The WLA for this facility was calculated by using the facility's 7- day average TSS limit (45 mg/L) and multiplying it by a conversion factor and the 80th percentile of the daily maximum flow (4.69 MGD). This facility was assigned a WLA of .88 tons/per day in the SD-BS-R-BIG_SIOUX_06 TMDL.

6.1.2 City of Brookings MS4 (NPDES Permit #SDR41A003)

The City of Brookings has a population in excess of 10,000 and, therefore, is subject to Phase II of the MS4 Program. Phase II MS4s are covered by a general permit. Each regulated MS4 is required to develop and implement a stormwater management program (SWMP) to reduce contamination from stormwater runoff and prohibit illicit discharges. A storm water management model (SWMM) was completed by Banner and Associates in 2004 as part of the Brookings Master Plan (2015). The expanded Phase II program required small MS4s in urbanized areas to obtain NPDES permits and implement minimum control measures.

In order to quantify the current total suspended load from the City of Brookings MS4, the jurisdictional area approach[3] was used:

$$(TMDL - WLA - MOS) * Area_{MS4} = MS4\ Load$$

The Brookings MS4 area encompasses roughly 8,500 acres. The MS4 covers approximately 2.91% of the SD-BS-R-BIG_SIOUX_05 watershed area and 2.10% of the SD-BS-R-BIG_SIOUX_06 watershed. The calculated MS4 load was estimated at the five flow zones for the SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 watershed. As seen in ***Table 5***, the average calculated MS4 load for SD-BS-R-BIG_SIOUX_05 varies from 1.26E-01 tons/day in the low flow zone to 3.02E+01 ton/day in the high flow zone. As seen in ***Table 6***, the average calculated MS4 load for SD-BS-R-BIG_SIOUX_06 varies from 8.88E-02 ton/day in the low flow zone to 2.54E+01 ton/day in the high flow zone.

[3] Total Maximum Daily Loads with Stormwater Sources: A Summary of 17 TMDLs

Table 5 - MS4 Calculated Loadings for SD-BS-R-BIG_SIOUX_05

SD-BS-R-BIG_SIOUX_05 - Flow Zone	TMDL Load at Standard (Ton/day)	WLA	MOS	MS4 (Area)	MS4 Load
High Flows	1.15E+03	6.00E-02	1.15E+02	0.029100623	3.02E+01
Moist Conditions	2.41E+02	6.00E-02	2.41E+01	0.029100623	6.32E+00
Mid-Range Conditions	4.87E+01	6.00E-02	4.87E+00	0.029100623	1.27E+00
Dry Conditions	2.34E+01	6.00E-02	2.34E+00	0.029100623	6.10E-01
Low Flows	4.87E+00	6.00E-02	4.87E-01	0.029100623	1.26E-01

Table 6 - MS4 Calculated Loadings for SD-BS-R-BIG_SIOUX_06

SD-BS-R-BIG_SIOUX_06- Flow Zone	TMDL Load at Standard (Ton/day)	WLA	MOS	MS4 (Area)	MS4 Load
High Flows	1.35E+03	8.80E-01	1.35E+02	0.021026129	2.54E+01
Moist Conditions	2.81E+02	8.80E-01	2.81E+01	0.021026129	5.31E+00
Mid-Range Conditions	5.67E+01	8.80E-01	5.67E+00	0.021026129	1.05E+00
Dry Conditions	2.72E+01	8.80E-01	2.72E+00	0.021026129	4.97E-01
Low Flows	5.67E+00	8.80E-01	5.67E-01	0.021026129	8.88E-02

The Simple Method was used to quantify the estimated load reductions needed for SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 MS4 loadings (Scheuler, 1987). The Simple Method calculation procedure is documented in ***Appendix C***. Storm water samples collected at 10 stations (BROOKSW01- BROOKSW10) from 2012 and 2013 were used to estimate MS4 load reductions. Sediment loads were estimated so that the urban stormwater source could be compared to other nonpoint source pollution sources. Stormwater runoff from the City of Brookings is transported through the MS4 and discharged into either Six Mile Creek (tributary of SD-BS-R-BIG_SIOUX_05) or continues south to enter the mainstem of SD-BS-R-BIG_SIOUX_06. The estimated reduction of the MS4 area for each segment is based on an average annual rainfall and the concentrations collected from each of the sampling stations that correspond to each segment.

Stormwater sampling stations are represented in ***Figure 5***. A statistical analysis of TSS concentrations from stations that drain to SD-BS-R-BIG_SIOUX_05 are portrayed in ***Figure 6***, while stations that drain toward SD-BS-R-BIG_SIOUX_06 are portrayed in ***Figure 7***.

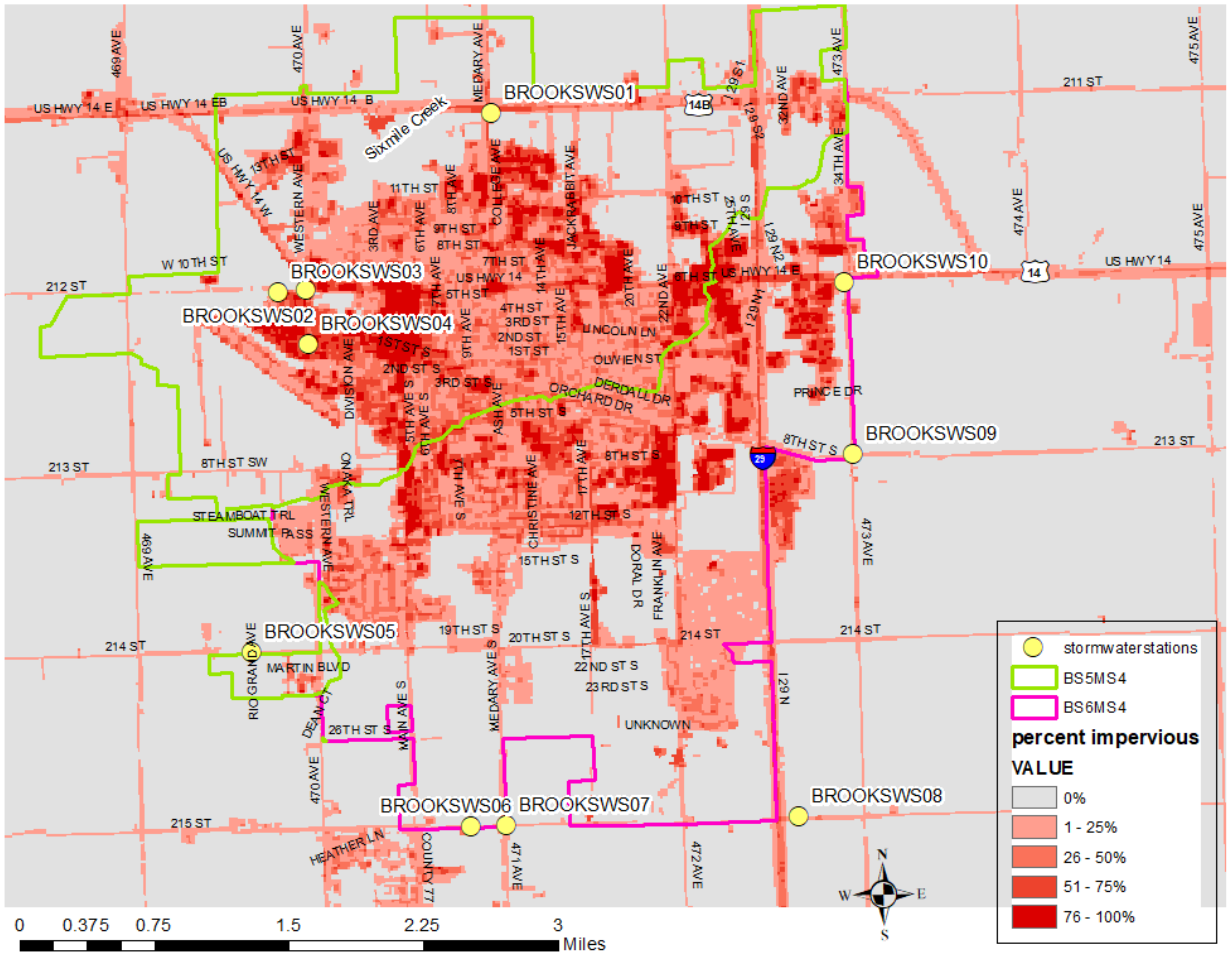

Figure 5 - Impervious Surfaces and Brookings Stormwater Stations

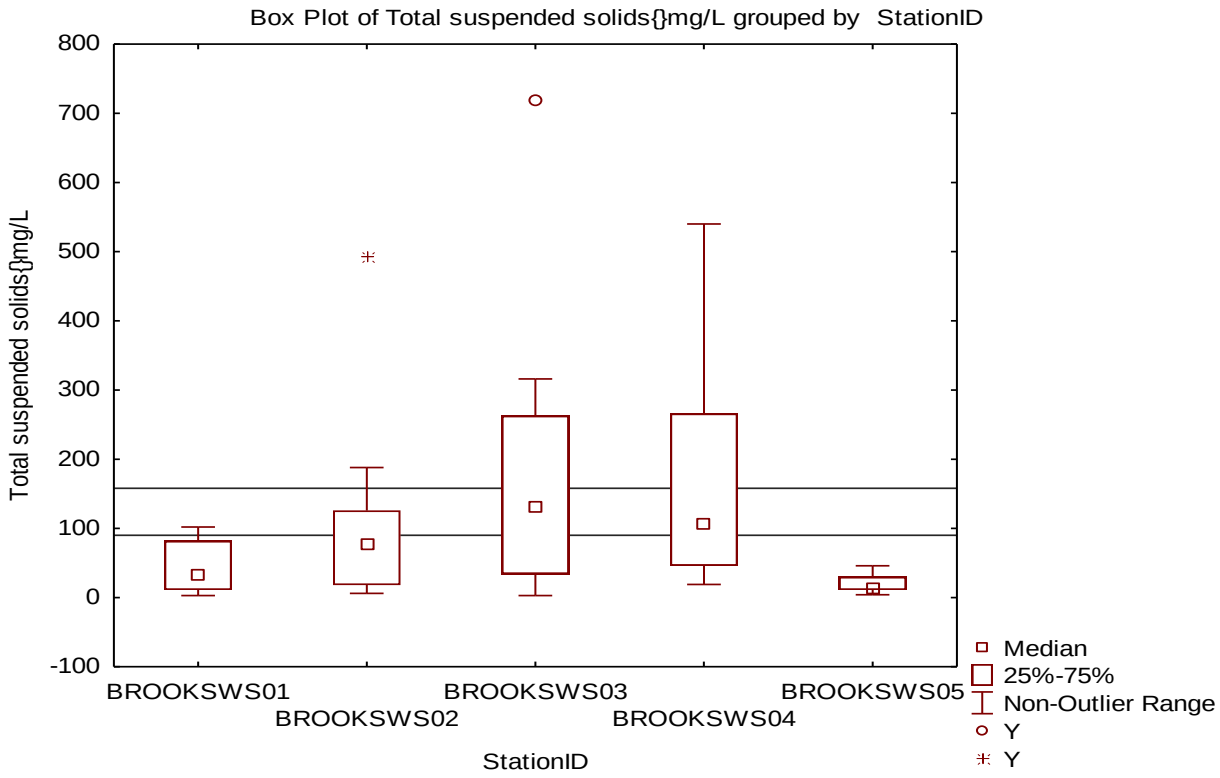

Figure 6 - Stormwater Stations that drain to SD-BS-R-BIG_SIOUX_05

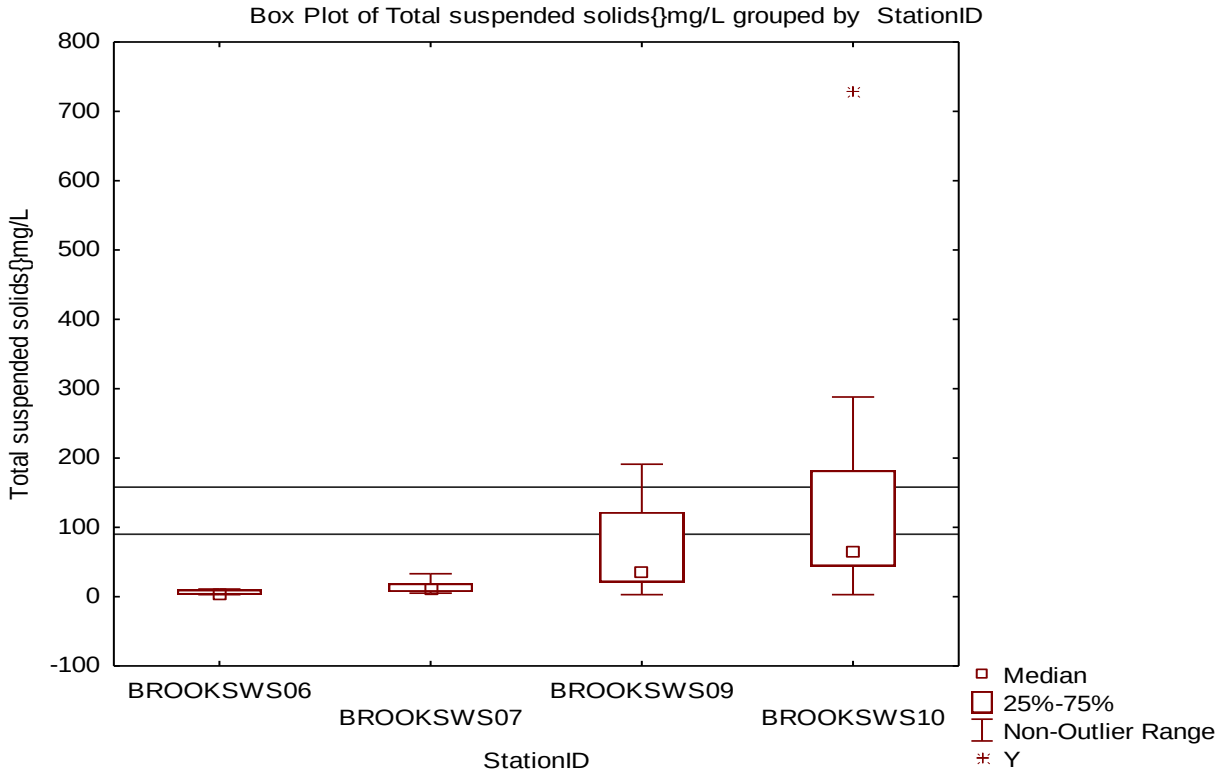

Figure 7 - Stormwater Stations the drain to SD-BS-R-BIG_SIOUX_06

Stormwater samples did produce moderate exceedance rates of the TSS standard for warmwater semipermanent fish life (> 158 mg/L SSM or > 90 mg/L 30-day average). Of the five urban stormwater stations that drain to SD-BS-R-BIG_SIOUX_05, there had been a total of 49 samples collected. Of the 49 samples, 12 exceeded the SSM and 18 exceeded the chronic 30-day mean standard. The remaining five stormwater stations that drain to SD-BS-R-BIG_SIOUX_06 had a total of 33 samples collected. Of the 33 samples, 5 exceeded the SSM and 7 exceeded the chronic standard. The MS4 component of the TSS load will be included in the TMDL's waste load calculations.

6.1.3 CAFOs in the Watershed

There are eight permitted Concentrated Animal Feeding Operations (CAFOs) within the SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 watershed. Each of the CAFO's facility name, type of operation, and permit number can be found in ***Table 6***. All CAFOs are required to maintain compliance with provisions of the SD Water Pollution Control Act (SDCL 34A-2). SDCL 34A-2-36.2 requires each concentrated animal feeding operation, as defined by Title 40 Codified Federal Regulations Part 122.23 dated January 1, 2007, to operate under a general or individual water pollution control permit issued pursuant to 34A-2-36. The general permit ensures that all CAFOs in SD have permit coverage regardless of if they meet conditions for coverage under a NPDES permit.

All facilities with a general permit number that starts with SDG-01* are covered under the 2003 General Water Pollution Control Permit for Concentrated Animal Feeding Operations. These permits require housed lots to have no discharge of solid or liquid manure to waters of the state, and allows open lots to only have a discharge of manure or process wastewaters from properly designed, constructed, operated and maintained manure management systems in the event of 25-years, 24-hour or 100-year, 24-hour storm event if they meet the permit conditions. The general permit was reissued and became effective on April 15, 2017. All CAFOs with coverage under the 2003 general permit have a deadline to apply for coverage under the 2017 general permit.

All facilities with a general permit number that starts with SDG-1* are covered under the 2017 General Water Pollution Control Permit for Concentrated Animal Feeding Operations. The 2017 general permit allows no discharge of manure or process wastewater from operations with state permit coverage or NPDES permit coverage for new source swine, poultry, and veal operations, and other housed lots with covered manure containment systems. Operations also have the option to apply for a state issued NPDES permit. Operations covered by the 2017 general permit or NPDES permit for open or housed lots with uncovered manure containment systems can only discharge manure or process wastewater from properly designed, constructed, operated and maintained manure management systems in the event of 25-year, 24-hour storm event if they meet the permit conditions.

Table 7 - CAFOs in the Big Sioux Watershed

North Deer Creek	HUC10-1017020207	
Name of Facility	**Type of Operation**	**SD General Permit #**
Hammink Dairy, LLC	dairy cattle (housed lot)	SDG-100065
Providence Dairy, L.L.C.	dairy cattle (housed lot)	SDG-100209
Red Willow Hutterian Brethren, Inc.	farrow to finish swine (housed lot)	SDG-109129
Portion of Battle Creek	HUC10-1017020208	
Name of Facility	**Type of Operation**	**SD General Permit #**
Camridge Hutterian Brethren, Inc.	beef cattle (open lot)	SDG-100526
Clint Overskei Swine Finisher	finisher swine (housed lot)	SDG-100442
Old Tree Farms, LLC	dairy cattle (housed lot)	SDG-100006
Southern Portion of Upper Big Sioux	HUC10-1017020211	
Name of Facility	**Type of Operation**	**SD General Permit #**
Kevin Triebwasser Swine Finisher	finisher swine (housed lot)	SDG-100358
Linde Dairy, LLC	dairy cattle (housed lot)	SDG-100054
Six Mile	HUC10-1017020206	
No permitted CAFOs		

For more information about South Dakota's CAFO requirements and general permits visit: DANR Concentrated Animal Feeding Operations.[4] As long as these facilities comply with the general CAFO permit requirements ensuring their discharges are unlikely and indirect loading events, the TMDL assumes their TSS contribution is minimal, and unless found otherwise, no additional permit conditions are required by this TMDL.

6.2 Natural and Nonpoint Sources of Sedimentation

Sediment production and transport is a natural occurrence within watersheds. Natural sources of TSS in the watershed exist outside of human-caused influences. There are several potential natural sources of sediment in the SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 watershed. Natural sediment sources in the watershed include overland runoff and in-stream bed and bank erosion. Natural sources are not assigned a separate allocation in the TMDL but rather the allowable natural loading is combined with human-caused nonpoint sources and represented in the load allocation (LA). Because natural loading generally cannot be reduced through the implementation of Best Management Practices (BMPs), any reductions assigned to the LA are expected to be realized through restoration activities associated with human-caused nonpoint sources.

Human activities can accelerate the natural erosional processes in a watershed, exacerbating sediment contributions to waterways. Anthropogenic activities such as civil construction of bridges, roads, culverts, and the installation of drain tile from agricultural activities has increased the erosive force on riverbanks and beds. Land use changes over the years have led to the removal of riparian vegetation which increases sediment loading within the watershed.

6.2.1 Sediment Load Estimates

It was estimated that between 10 - 25% of the sediment in the Big Sioux River originated from bed and bank erosion, with 15% of the sediment load in an average year (Bankhead and Simon,

[4] https://danr.sd.gov/Agriculture/Livestock/FeedlotPermit/docs/2017GeneralPermit.pdf

2009). According to Klimetz, Simon, and Schwartz (2009), the region under assessment has a moderately unstable stream category (threshold of .8-7.9 T/y/km^2). The sediment yield at the USGS gage 06480000 was reported at 2.8 T/y/km^2. A sediment budget for each segment was created using 2.8 T/yr/km^2 as the annual average total for the sediment yield. The combined watershed area is 287,104 acres. A budget based on the bed and bank percentage of 15% (Bankhead and Simon, 2009), the HIT model (tons/acre/yr), and the number of 15m^2 pixels were used to derive the percent sediment contribution to sediment load from NLCD classes (***Table 8***). A discussion of the HIT model can be found in ***Appendix D***.

Table 8 - Load Allocation by Land Use

Load allocation								percent sediment contribution to sediment load
Bed and Bank		15%	487.95	T/yr				15%
Uplands		85%	2765	T/yr				
		upland sediment percentage			HIT-count-15m^2 pixels	HIT to acres	HIT-sum tons/acre/year	
	row crop	86%	2388.96	T/yr	817690	3030.839	5406.516087	73.44%
	small grain	0%	1.80	T/yr	23493	87.07884	142.127962	0.06%
	hay	1%	14.48	T/yr	70736	262.1891	378.872933	0.45%
	grassland	10%	263.73	T/yr	225543	835.9947	2163.810247	8.11%
	barren	0%	0.02	T/yr	3867	14.33337	8.533546	0.00%
	water	0%	0.11	T/yr	20698	76.71893	9.925652	0.00%
	developed	3%	94.53	T/yr	75816	281.0186	2307.299091	2.91%
	forest	0%	0.25	T/yr	10012	37.11035	46.367145	0.01%
	wetland	0%	1.12	T/yr	28783	106.6867	71.828357	0.03%

7.0 Data Collection

7.1 Water Quality Data and Discharge Information

Daily flow values and paired TSS concentrations are essential elements of TMDL development. TSS data was obtained from six monitoring stations at two different locations within the impaired segments over the assessment period between 2000 – 2023.

7.2 TSS Water Quality Data

All applicable TSS data collected within the impaired segments during the assessment years 2000 - 2023 were used for TMDL development. TSS data was obtained from multiple monitoring sites, many of which were established during past watershed assessment projects. All data collection conducted during projects followed methods in accordance with the South Dakota *Standard Operating Procedures for Field Samplers* developed by the Watershed Protection Program of SD DANR. Water samples were sent to the State Health Laboratory in Pierre, SD for analysis. All water quality data and corresponding daily flow data used for TMDL development can be found in ***Appendix A***.

TSS data was collected over a series of projects with many stations used in more than one project. The Central Big Sioux Watershed Assessment Project (CENTBSR1) ran from 1999 to 2000 and included stations CENTBSRR01 and CENTBSRR03. Next, when implementation in the basin really took off, the Central Big Sioux Implementation Project (CENTBSR2) ran from 2006 to

2009. East Dakota Water Development District continued monitoring throughout the basin using many of the same sites that are still active today. That project is abbreviated EDWQSPZ1 and includes stations CENTBSRR01, CENTBSRR03, NCENBSRR19, and NCENBSRR20. The Brookings storm water project ran in 2012 and 2013 and included site BIGSIOUX01. Monitoring station 460662 in SD-BS-R-BIG_SIOUX_05 and 460702 in SD-BS-R-BIG_SIOUX_06 are long-term water monitoring sites established as part of SD DANR's ambient water quality monitoring network. These monitoring stations will also provide a long-term dataset to evaluate compliance. Data by station are summarized below in ***Table 9***. All the sites for SD-BS-R-BIG_SIOUX_05 are co-located: 460662, CENTBSRR01, and NCENBSRR01. All the sites for SD-BS-R-BIG_SIOUX_06 are co-located: 460702, CENTBSRR03, and BIGSIOUX01.

Table 9 - Water Quality Data

Big Sioux Segment	Station ID	Number of Grab Samples
SD-BS-R-BIG_SIOUX_05	460662	273
SD-BS-R-BIG_SIOUX_05	CENTBSRR01	129
SD-BS-R-BIG_SIOUX_05	NCENBSRR01	17
SD-BS-R-BIG_SIOUX_06	460702	276
SD-BS-R-BIG_SIOUX_06	BIGSIOUX01	51
SD-BS-R-BIG_SIOUX_06	CENTBSRR03	96

After a preliminary look over the data, 419 TSS samples were available for analysis within SD-BS-R-BIG_SIOUX_05 and 423 samples within SD-BS-R-BIG_SIOUX_06. When multiple stations within the same segment were sampled on the same day, the highest concentration TSS sample was used to calculate the load. Each station had multiple samples above the SSM water quality standard (158 mg/L). Chronic exceedances must have three samples in a 30-day period that were collected on separate weeks. Twenty chronic exceedances for TSS occurred in SD-BS-R-BIG_SIOUX_05 and twenty-one exceedances occurred in SD-BS-R-BIG_SIOUX_06.

7.3 Flow Information and Data

Long term hydrologic records were available via the USGS gage station located downstream of SD-BS-R-BIG_SIOUX_06. The USGS gage station identified as 06480000 is located approximately 10 miles south of Brookings, SD and 2 miles south of the Brookings-Moody County line where SD-BS-R-BIG_SIOUX_06 ends. Flow data acquired at this site began in 1953 and is currently active as of 2024. Flow data from the period of assessment (2000 – 2023) was used to develop the load duration curve (LDC) and the TMDL for SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06.

As SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 do not have stream gages located at the end of their respective segments, StreamStats was used to estimate the drainage area of both segments. Utilizing the USGS StreamStats Tool, the contributing drainage area into USGS gage 06480000 is approximately 2419 square miles (1,548,160 acres). This watershed area value is significantly greater than the watershed area of SD-BS-R-BIG_SIOUX_05 (156,807 acres) and SD-BS-R-BIG_SIOUX_06 (194,615 acres) because the entire watered area upstream of 06480000 is required for the analysis rather than the watershed area for SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 alone. StreamStats estimated the approximate drainage area for SD-BS-R-

BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 as 1940.09 square miles and 2261.47 square miles, respectively. Flows at the TMDL segments were then estimated using the drainage area ratio method (Williams-Sether, 1992).

7.4 Rapid Geomorphic Assessment

Rapid geomorphic assessments (RGAs) help identify unstable portions of the channel. RGAs were conducted on the Big Sioux River in 2007 and assessed in accordance with the *Standard Operating Procedures for Field Samplers* developed by the Watershed Protection Program of SD DANR. RGAs are an assessment to determine the stability of stream bed and banks and considers stream bed composition, bank vegetation, existence of failing stream banks, presence of erosional and depositional areas, widening and downcutting processes, and stages of channel evolution.

The RGA are given a score between 0 and 30. Higher RGA scores indicate more unstable banks which contribute more sediment to the river. A score of 10 and under are associated with streams of stable ranking. Scores between 10 and 20 are associated with streams that have some degree of instability (Klimetz, Simon, & Schwartz, 2009). After the first station on SD-BS-R-BIG_SIOUX_05, the channel is in poor condition. The RGA indicates a problem on this stretch of river with a note on hoof action and overgrazing in the area. Then, after North Deer Creek enters the Big Sioux River, channel conditions dramatically improve. By the end of SD-BS-R-BIG_SIOUX_06, the channel is back in the condition it was at the beginning of SD-BS-R-BIG_SIOUX_05 (***Figure 8)***.

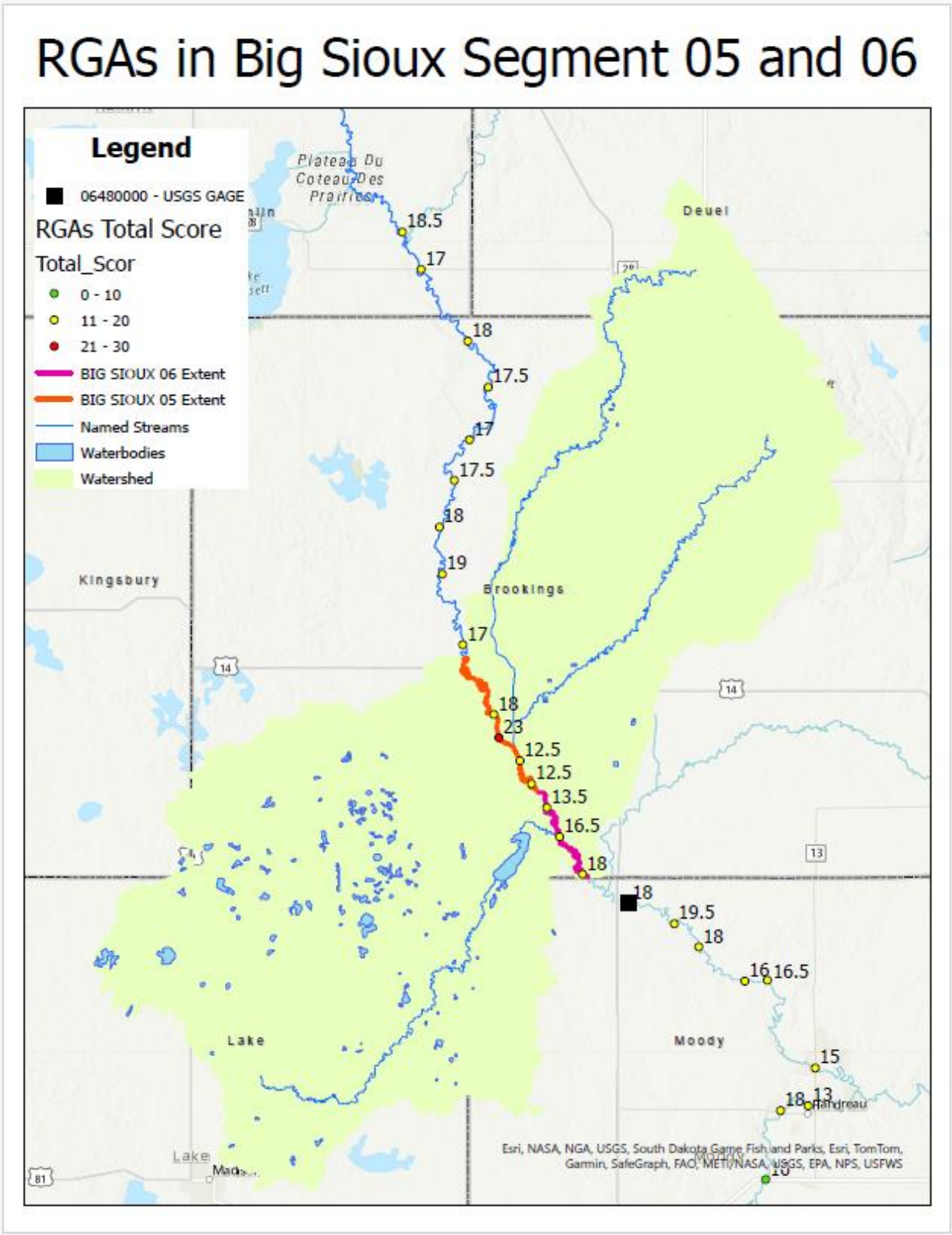

Figure 8 - RGAs in Big Sioux Segment 5 and 6 Watershed

8.0 TMDL Allocations

Contributing factors of pollution are split between point and nonpoint sources. Wasteload allocations (WLAs) are the allocated loads for point sources including all sources subject to regulation under the NPDES program. Therefore, load allocations are the sum of nonpoint sources as well as natural background sources. The TMDL (or loading capacity) is the sum of WLAs, LAs, and a margin of safety (MOS).

A TMDL is expressed by the equation: TMDL = ΣWLA + ΣLA + MOS, where:

ΣWLA is the sum of the wasteload allocation(s) (point sources)
ΣLA is the sum of the load allocation(s) (nonpoint sources)
MOS = margin of safety

8.1 Margin of Safety (MOS)

In accordance with regulations, a margin of safety was established to account for uncertainty in the data analyses. A margin of safety may be provided (1) by using conservative assumptions in the calculation of the loading capacity of the waterbody and (2) by establishing allocations that in total are lower than the defined loading capacity. In the case of SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06, the latter approach was used to establish a safety margin on the TSS TMDLs.

A 10% explicit MOS was calculated within the duration curve framework to account for uncertainty (e.g., loads from tributary streams, effectiveness of controls, etc.). This 10% explicit MOS was calculated from the TMDL within each flow zone. The remaining assimilative capacity was attributed to nonpoint sources (LA) or point sources (WLA).

8.2 Wasteload Allocations (WLA)

All NPDES permitted facilities within the SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 watershed were identified and reviewed for WLA consideration in **Section 6.1**. Of the nine entities with NPDES permits, three were given a WLA in this TMDL. Segment SD-BS-R-BIG_SIOUX_05 has only one point source discharger identified as the City of Volga's WWTF (#SD0021920) and was assigned a WLA of 0.06 ton/day across all flow zones.

Segment SD-BS-R-BIG_SIOUX_06 has one point source discharger identified as the City of Brookings WWTF (#SD0023388) and was assigned a WLA of 0.88 ton/day across all flow zones.

Both SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 were given a WLA for the City of Brookings MS4 (#SDR41A003). To calculate the WLA assigned to the City of Brookings MS4, the jurisdictional area approach was used. The MS4 covers approximately 2.91% of the SD-BS-R-BIG_SIOUX_05 watershed area and 2.10% of the area that drains to the SD-BS-R-BIG_SIOUX_06 watershed.

There are eight permitted CAFOs in the SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 watershed. CAFOs were not assigned a WLA in the TMDL given they are not

permitted to discharge their waste in accordance with provisions of their NPDES permits. The WLA was set at zero in all five flow zones for both segments of the Big Sioux River.

8.3 Load Allocations (LA)

EPA regulations require that a TMDL include LAs, which identify the loading capacity from nonpoint sources and sources of natural background. The LA was calculated by subtracting the 10% explicit MOS and WLA from the TMDL load at the standard for each flow zone (seen in the equation below).

$$\text{LA} = \text{TMDL (-) MOS (-) WLA}$$

9.0 Total Suspended Solids TMDL Loading Analysis

The TMDL for each segment was developed using the Load Duration Curve (LDC) framework. A LDC model is a representation of the allowable loading capacity of a pollutant based on the relevant water quality criterion. The LDC considers the impaired segments entire flow regime, determining the total maximum daily load at any given flow variable. In both analyses, SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 were separated into five flow zones (***Figure 9 and Figure 10***); high flows (0 – 10 percent), moist conditions (10 – 40 percent), mid-range conditions (40 – 60 percent), dry conditions (60 – 90 percent), and low flows (90 – 100 percent) in accordance with EPA guidance (USEPA, 2007).

In **Section 3.4**, it was established that the numeric target for SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 was set at the chronic criterion of 90 mg/L. The LDC is developed using the chronic criterion and multiplying it by the average daily flow and a unit conversion factor (4.172×10^{-3}).

$$flow\ (MGD) * 90\ (\frac{mg}{L}) * conversion\ factor = \ TMDL$$

TSS observations from 2000 – 2023 from all six stations in SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 will be used for calculating TMDL loading and reductions. When TSS loading observations are plotted on the LDC, characteristics of the water quality impairment are shown. Observations that are plotted above the curve are exceeding the TMDL, while those below the curve are in compliance with the water quality standards.

9.1 SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 TMDL Loading Analysis

The TMDL for SD-BS-R-BIG_SIOUX_05 is portrayed in ***Figure 9*** and by flow zone in ***Table 10***. TSS observations collected from SD-BS-R-BIG_SIOUX_05 exceed the TMDL in all flow zones. Samples that exceeded the TSS numeric target of 90 mg/L were most common in the 10^{th} – 90^{th} percentiles. The TMDL for SD-BS-R-BIG_SIOUX_06 is portrayed in ***Figure 10*** and by flow zone in ***Table 11***. TSS observations collected from SD-BS-R-BIG_SIOUX_06 exceed the TMDL in all flow zones. The most common occurrence of violations occurs during the moist condition flows.

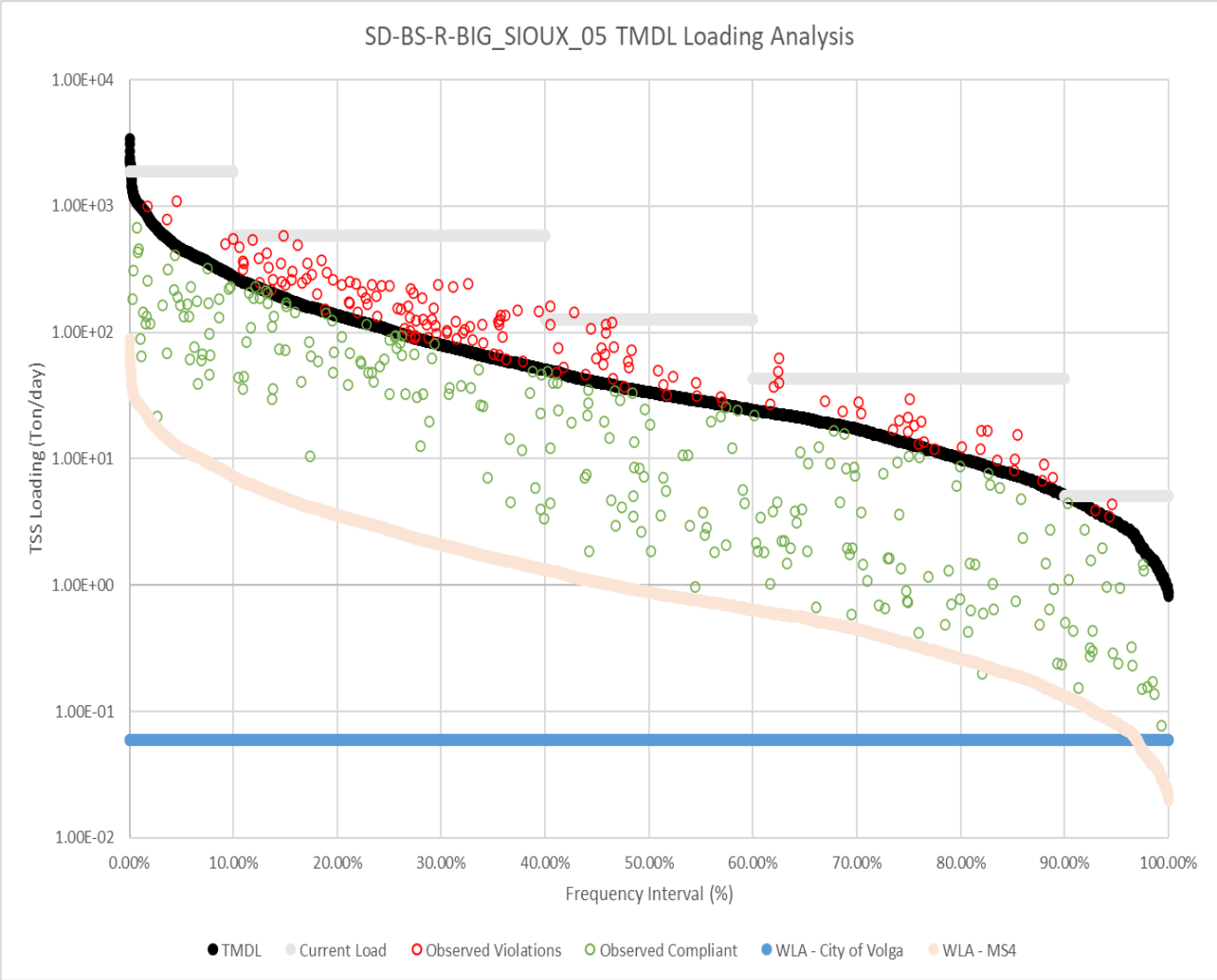

Figure 9 - SD-BS-R-BIG_SIOUX_05 Loading Analysis

Table 10 - SD-BS-R-BIG_SIOUX_05 TMDL Table

Warmwater Semipermanent Fish Life Propagation TSS TMDL	BIG SIOUX 05 TMDL Table				
	High Flows	Moist Conditions	Mid-Range Conditions	Dry Conditions	Low Flows
Flow Rate	≤ 10.0%	10 - 40.0%	40.0 - 60.0%	60.0 - 90.0%	≥ 90.0%
WLA - City of Volga (Ton/day)	6.00E-02	6.00E-02	6.00E-02	6.00E-02	6.00E-02
WLA - MS4	3.02E+01	6.32E+00	1.27E+00	6.10E-01	1.26E-01
LA	1.01E+03	2.11E+02	4.25E+01	2.03E+01	4.19E+00
10% Explicit MOS	1.15E+02	2.41E+01	4.87E+00	2.34E+00	4.87E-01
TMDL @ 90 mg/L	1.15E+03	2.41E+02	4.87E+01	2.34E+01	4.87E+00
Current Load	1.88E+03	5.78E+02	1.27E+02	4.31E+01	5.04E+00
Load Reduction	39%	58%	62%	46%	4%

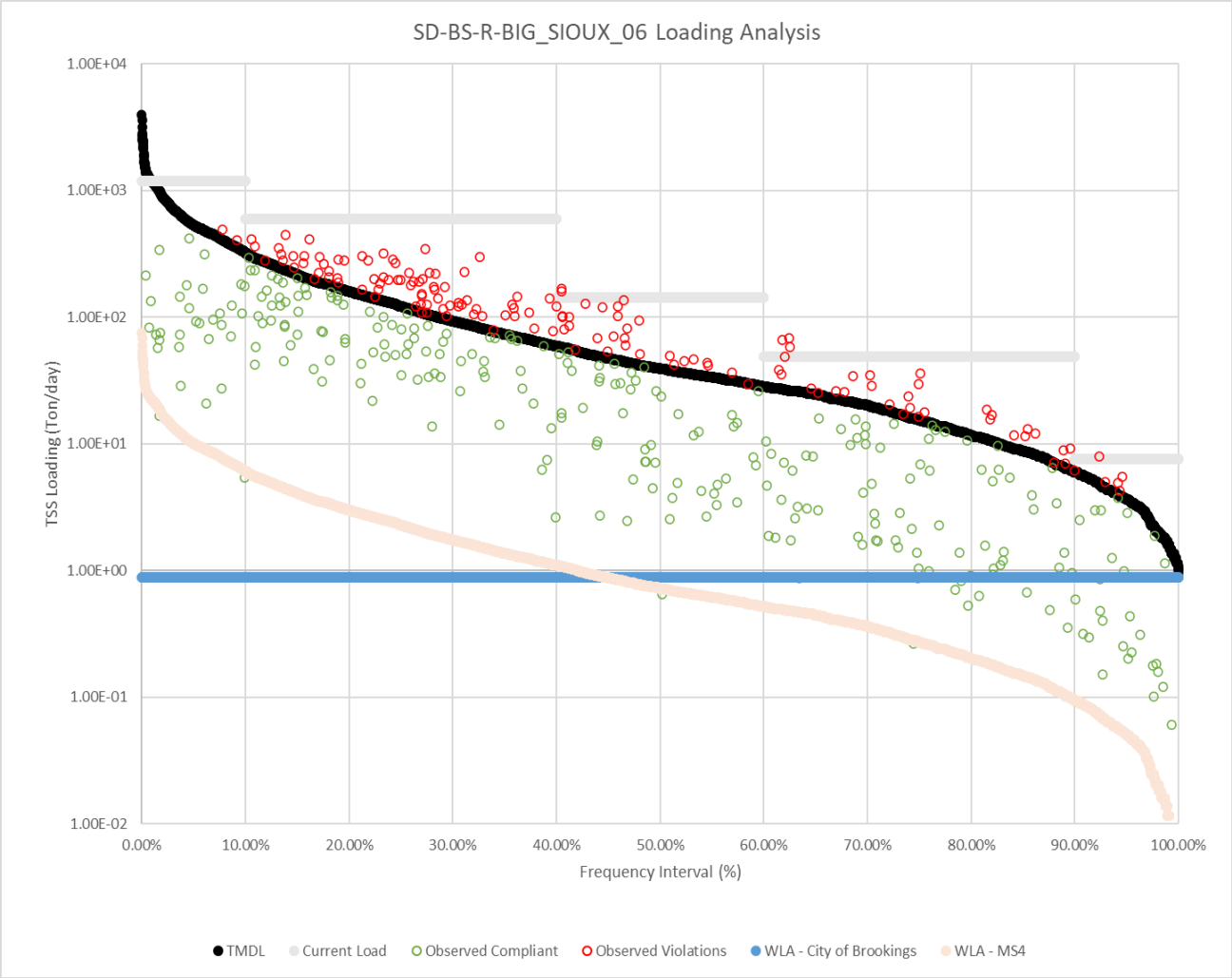

Figure 10 - SD-BS-R-BIG_SIOUX_06 Loading Analysis

Table 11 - SD-BS-R-BIG_SIOUX_06

Warmwater Semipermanent Fish Life Propagation TSS TMDL	BIG SIOUX 06 TMDL Table				
	High Flows	Moist Conditions	Mid-Range Conditions	Dry Conditions	Low Flows
Flow Rate	≤ 10.0%	10 - 40.0%	40.0 - 60.0%	60.0 - 90.0%	≥ 90.0%
WLA - City of Brookings WWTF	8.80E-01	8.80E-01	8.80E-01	8.80E-01	8.80E-01
WLA - MS4	2.54E+01	5.31E+00	1.05E+00	4.97E-01	8.88E-02
LA	1.18E+03	2.47E+02	4.91E+01	2.31E+01	4.14E+00
10% Explicit MOS	1.35E+02	2.81E+01	5.67E+00	2.72E+00	5.67E-01
TMDL @ 90 mg/L	1.35E+03	2.81E+02	5.67E+01	2.72E+01	5.67E+00
Current Load	1.19E+03	5.93E+02	1.42E+02	4.83E+01	7.57E+00
Load Reduction	0%	53%	60%	44%	25%

9.1.1 High Flows

The high flow zone for segment SD-BS-R-BIG_SIOUX_05 represents flows that were greater than or equal to 730.90 MGD (highest 10% of flows). The flows represented in this zone occur on an infrequent basis and are typically the result of significant run-off events such as spring snowmelt or intense rain events. Sediment sources across the watershed have the potential to be conveyed to the stream channel during high flow conditions. These high flows may have a dilution or scouring effect on sediment and so exceedance of the standards was low in this flow zone.

Of the 44 samples that were taken at SD-BS-R-BIG_SIOUX_05 within this flow zone, a total of 5 samples exceeded the numeric target of 90 mg/L. All 44 samples were used to calculate the current load of the zone and estimate reductions. The 95th percentile TSS concentration and flow was calculated at 146.55 mg/L and 3073.79 MGD, respectively. A reduction of 39% is needed in order to comply with the TMDL.

$$90\frac{mg}{L}(TMDL\ Target) * 3073.79\ MGD\ (95^{th}\ percentile\ flow) * conversion\ factor = 1.15E+03\ (\frac{Ton}{day})$$

The high flow zone for segment SD-BS-R-BIG_SIOUX_06 represents flows that were greater than or equal to 851.94 MGD. Of the 34 samples that were taken at SD-BS-R-BIG_SIOUX_06 within this flow zone, only 2 samples exceeded the numeric target of 90 mg/L. All 34 samples were used to calculate the current load of the zone and estimate reductions. The 95th percentile TSS concentration and flow was calculated at 79.60 mg/L and 3583.98 MGD, respectively. A load reduction is not required to achieve compliance with the TMDL.

$$90\frac{mg}{L}(TMDL\ Target) * 3583.98\ MGD\ (95^{th}\ percentile\ flow) * conversion\ factor = \ 1.35E+03\ (\frac{Ton}{day})$$

9.1.2 Moist Conditions

The moist condition zone for segment SD-BS-R-BIG_SIOUX_05 extends from approximately 730.90 – 134.8 MGD. Moist condition flows represent moderate storm events following snow melt, and moderate rainfall events. Of the 162 samples that were taken within this flow zone, a total of 87 samples exceeded 90 mg/L. The 95th percentile TSS concentration and flow was calculated at 215.5 mg/L and 642.75 MGD, respectively. A reduction of 58% is needed in order to comply with the TMDL.

$$90\frac{mg}{L}(TMDL\ Target) * 642.75\ MGD\ (95^{th}\ percentile\ flow) * conversion\ factor = 2.41E+02\ (\frac{Ton}{day})$$

The moist condition flow zone for segment SD-BS-R-BIG_SIOUX_06 extend approximately 851.94 – 157.10 MGD. Of the 34 samples that were taken, 2 samples exceeded the numeric target of 90 mg/L. All 34 samples were used to calculate the current load of the zone and estimate reductions. The 95th percentile TSS concentration and flow was calculated at 189.60 mg/L and 749.22 MGD, respectively. A load reduction of 53% is needed to comply with the TMDL.

$$90\frac{mg}{L}(TMDL\ Target) * 749.22\ MGD\ (95^{th}\ percentile\ flow) * conversion\ factor = 1.35E+03\ (\frac{Ton}{day})$$

9.1.3 Mid-range Conditions

Mid-range flow conditions for segment SD-BS-R-BIG_SIOUX_05 represent flows approximately from 134.8 – 64.8 MGD. Mid-range flows typically occur mid to late summer when vegetation is mature, and streamflow is sustained between precipitation events. Of the 79 samples that were taken within this flow zone, a total of 29 samples exceeded the numeric target. The 95th percentile TSS concentration and flow was calculated at 235.5 mg/L and 129.59 MGD, respectively. A reduction of 61.78% is needed in order to comply with the TMDL.

$$90\frac{mg}{L}(TMDL\ Target) * 129.59\ MGD\ (95^{th}\ percentile\ flow) * conversion\ factor = 4.87E+01\ (\frac{Ton}{day})$$

The mid-range condition for segment SD-BS-R-BIG_SIOUX_06 extends approximately 157.10 – 75.53 MGD. Of the 80 samples that were taken at SD-BS-R-BIG_SIOUX_06 within this flow zone, a total of 29 samples exceeded the numeric target of 90 mg/L. All 80 samples were used to calculate the current load of the zone and estimate reductions. The 95th percentile TSS concentration and flow was calculated at 224.80 mg/L and 151.05 MGD, respectively. A reduction of 60% is needed to comply with the TMDL.

$$90\frac{mg}{L}(TMDL\ Target) * 151.05\ MGD\ (95^{th}\ percentile\ flow) * conversion\ factor = 5.93E+02\ (\frac{Ton}{day})$$

9.1.4 Dry Conditions

Dry condition flows in segment SD-BS-R-BIG_SIOUX_05 represent flow rates between 64.8 – 26.6 MGD. Dry condition flows are best characterized as below the average base flow conditions influenced by periods of dryness or groundwater sources. TSS sources during dry conditions likely originate in the stream channel during dry flow conditions in winter and midsummer. Of the 106 samples that were taken within this flow zone, a total of 30 samples exceeded 90 mg/L. The 95th percentile TSS concentration and flow was calculated at 166 mg/L and 62.20 MGD, respectively. A reduction of 45.78% is needed in order to comply with the TMDL.

$$90\frac{mg}{L}(TMDL\ Target) * 62.20\ MGD\ (95^{th}\ percentile\ flow) * conversion\ factor = 2.34E+00\ (\frac{Ton}{day})$$

The dry condition for segment SD-BS-R-BIG_SIOUX_06 extends approximately 75.53 – 15.77 MGD. Of the 112 samples that were taken at SD-BS-R-BIG_SIOUX_06 within this flow zone, a total of 33 samples exceeded the numeric target of 90 mg/L. All 112 samples were used to calculate the current load of the zone and estimate reductions. The 95th percentile TSS concentration and flow was calculated at 159.60 mg/L and 72.51 MGD, respectively. A reduction of 44% is needed in the high flow zone to comply with the TMDL.

$$90\frac{mg}{L}(TMDL\ Target) * 72.51\ MGD\ (95^{th}\ percentile\ flow) * conversion\ factor = 2.72E+01\ (\frac{Ton}{day})$$

9.1.5 Low Flows

The low flow zone for segment SD-BS-R-BIG_SIOUX_06 represents flows at or below 26.6 MGD. Low flows are characterized as the flow of water in a stream during prolonged dry weather. Of the 28 samples that were taken within this flow zone, a total of 3 samples exceeded the numeric target of 90 mg/L. The 95th percentile TSS concentration and flow was calculated at

93.3 mg/L and 12.96 MGD, respectively. A reduction of 3.54% is needed in order to comply with the TMDL.

$$90\frac{mg}{L}(TMDL\ Target) * 12.96\ MGD\ (95^{th}\ percentile\ flow) * conversion\ factor = 4.87E+00\ (\frac{Ton}{day})$$

The low flow zone for segment SD-BS-R-BIG_SIOUX_06 represents flows at or below 15.77 MGD. Of the 32 samples that were taken at SD-BS-R-BIG_SIOUX_06 within this flow zone, a total of 5 samples exceeded the numeric target of 90 mg/L. All 32 samples were used to calculate the current load of the zone and estimate reductions. The 95th percentile TSS concentration and flow was calculated at 120 mg/L and 15.11 MGD, respectively. A reduction of 25% is needed in order to comply with the TMDL.

$$90\frac{mg}{L}(TMDL\ Target) * 15.11\ MGD\ (95^{th}\ percentile\ flow) * conversion\ factor = 5.67E+00\ (\frac{Ton}{day})$$

10.0 Seasonality

Flow values from USGS gage 06480000 and TSS samples collected throughout the assessment period showed seasonal variation as shown in ***Figure 11*** and ***Figure 12*** below. TSS samples collected showed higher variability in the spring and summer months, with samples collected in July having the highest median value. Flows peaked in March and were the highest in the spring and early summer months which is typical of South Dakota streams.

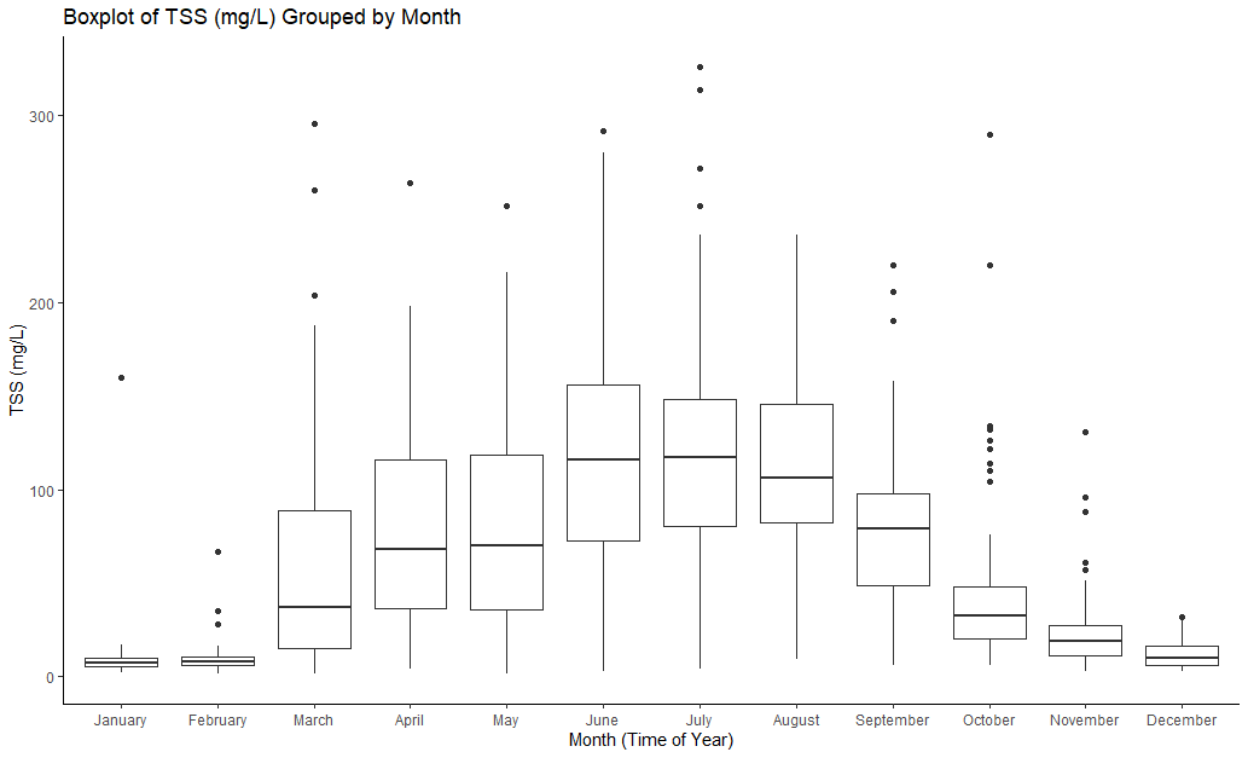

Figure 11 - Seasonality of TSS Concentrations

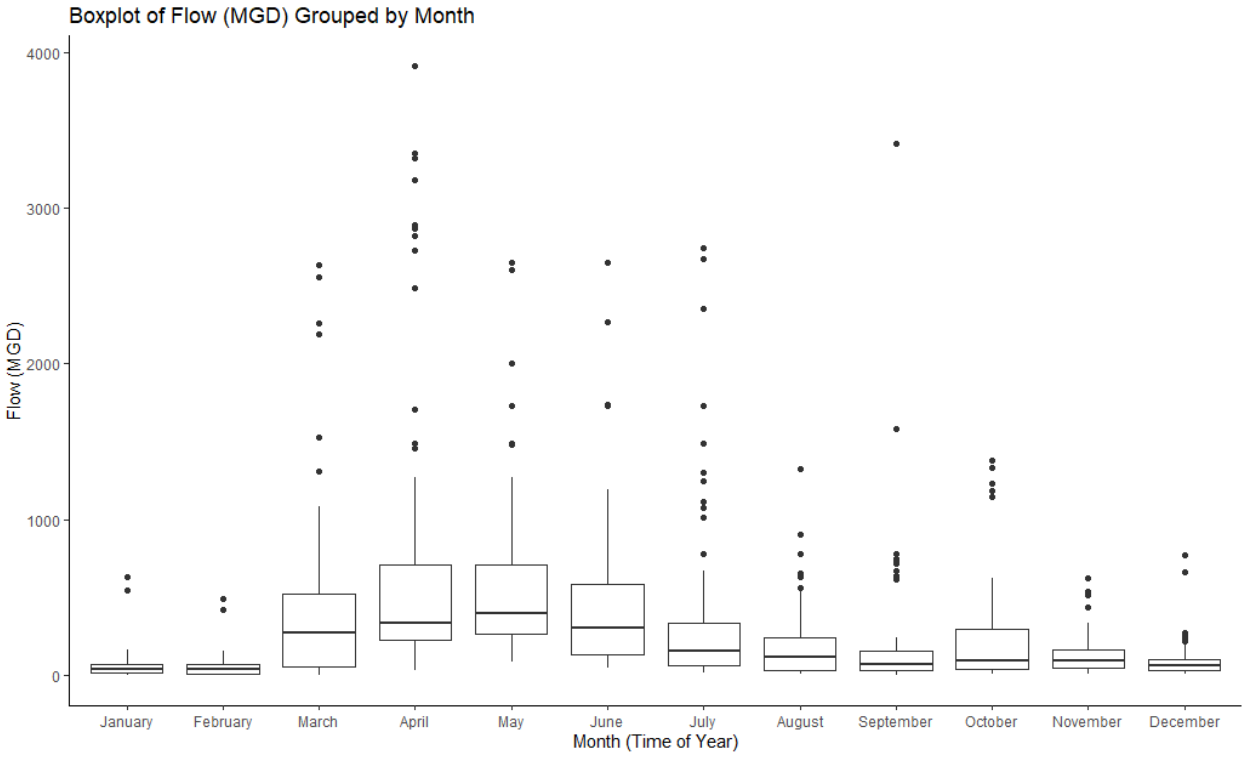

Figure 12 - Seasonality of Flow

11.0 Critical Conditions

During critical condition periods, if water quality standards were met under those conditions, it would be likely that the water quality standards would be met overall (US EPA, 2007). TSS violations in SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 are greatest during 10 – 90% flow frequencies. As a result, remediation efforts should focus on reducing TSS in SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 segments by implementing best management practices that focus on limiting watershed-scale runoff from moist conditions, mid-range conditions, and dry conditions. Implementing these practices will mitigate this critical condition in order to meet reduction goals and maintain the water quality criteria set forth in this TMDL. Proposed BMPs are described in detail in **Section 12.2**.

12.0 Water Quality Improvement Plan and Monitoring Strategy

To ensure attainment of the TMDL, Best Management Practices (BMPs) will need to be implemented. Additional monitoring and evaluation efforts will be targeted toward the effectiveness of implemented BMPs.

12.1 Monitoring Strategy

Monitoring is a necessary component for assuring the attainment of the TMDL. The focus of monitoring is to evaluate methods for reducing loads from identified nonpoint and point sources

of TSS as well as the continued evaluation of TSS conditions in SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06.

Long-term monitoring will continue for segment SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 as part of SD DANR's ambient water monitoring program at WQM station 460662 and 460702, respectively. In addition, East Dakota Water Development District (EDWDD) will continue monitoring at both stations through internal project means and through the efforts of future Rotating Basin Project Partnerships. Sampling is expected to continue indefinitely dependent on resource availability and funding. USGS staff will continue to maintain the continuous stream gage identified as 06480000 so long as it is appropriate. Additional monitoring will be focused on the effectiveness of implemented BMPs.

12.2 Implementation

Watershed-scale implementation projects can be accomplished by using financial and technical assistance through SD DANR. Financial support is administered to implementation projects aiming to protect and improve the water quality in South Dakota. SD DANR administers several major funding programs that provide low interest loans and grants for projects that protect and improve water quality in South Dakota. Funding provided by DANR includes the Consolidated Water Facilities Construction program, Clean Water State Revolving Fund (SRF) program, Section 319 Nonpoint Sources Management Program, and the South Dakota Legislature House Bill 1256 Program (Riparian Buffer Initiative Program).[5]

Working with current 319 implementation projects such as the Big Sioux River Implementation Project and the Prairie Coteau Watershed Improvement and Protection Project provides collaborative solutions for reducing sediment in the Big Sioux River. An educational project, Soil Health Planning and Improvement Project, provides educational outreach programs to producers to help maintain healthy soil through practicing the five soil health principles. Additionally, the City of Brookings has established a *Brookings Master Drainage Plan* in an effort to make improvements to the City's stormwater infrastructure which will aid in maintaining and improving water quality (2008).

SD DANR recommends several BMPs to reduce runoff and sediment sources within the SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 segments. As row crops are the primary contributor to sediment in the Big Sioux River, the following practices are recommended to reduce sediment-laden runoff:

- Relocate livestock feeding and grazing areas away from streams especially sloped areas near streams.
- Protect the riparian corridors and keep permanent vegetation along creek. Unstable banks should be protected to improve erosion control. Restoring vegetation and limiting streambank use will allow these areas to recover.
- Maintain vegetated buffer between stream and cropland or pastureland, use filter strips where needed.
- Control animal feeding operations and ensure proper waste management.

[5] https://sdlegislature.gov/Session/Bill/22363/220116

- Preliminary evidence suggests that slowing flow by ponding water may have beneficial effects in reducing sediment. Practices that increase infiltration and reduce runoff are beneficial.
- Conserving wetlands and sloughs can slow runoff and improve water quality.
- Top-bank and bank-toe protections.
- Promote soil health to increase infiltration and reduce sediment-laden run off.

Some best management practices to reduce urban stormwater include:

- Utilize best management practices including detention and retention to reduce storm water runoff and sequester bacteria.

12.3 Adaptive Management

SD DANR may adjust the LA and/or WLA allocations in this TMDL to account for new information or circumstances identified during the implementation of the TMDL. If a review of the new information or circumstances indicates that an adjustment to the LA and WLA is appropriate, then the TMDL will be updated following SD DANR programmatic steps including public participation. New information generated during TMDL implementation may include, among other things, monitoring data, BMP effectiveness information and land use information. SD DANR will propose adjustments only in the event that any adjusted LA or WLA will not result in a change to the loading capacity; the adjusted TMDL, including its WLAs and LAs, will be set at a level necessary to implement the applicable water quality standards and any adjusted WLA will be supported by a demonstration that load allocations are practicable. SD DANR will follow EPA guidance for revising or withdrawing TMDLs in accordance with considerations documented in EPA's 2012 draft memo before taking action.[6]

12.4 Public Participation

STATE AGENCIES

South Dakota Department of Agriculture and Natural Resources (SD DANR) was the primary state agency involved in the completion of this assessment. SD DANR provided technical support and equipment throughout the course of the project.

A 30-day public comment period was issued for the original draft TMDL. A public notice letter was published in the Sioux Falls Argus Leader, Brookings Register and Moody County Enterprise newspapers. The draft TMDL document and ability to comment was made available on DANRs One-Stop Public Notice Page at: DANR Public Notices (sd.gov). The public notice period began August 28th, 2024 and ended September 28th, 2024. One member of the public provided comments and DANR provided responses to their comments, which is recorded in Appendix E.

FEDERAL AGENCIES

Environmental Protection Agency (EPA) provided the primary source of funds through the 319(d), 106, and 604(b) sections of the Clean Water Act for approved nonpoint source management

[6] http://www.epa.gov.sites.production/files/2015-10/documents/draft-tmdl 32212.pdf

projects. EPA provided technical support and review during TMDL Development. EPA's approval letter and decision document are provided in ***Appendix D***.

LOCAL GOVERNMENT, INDUSTRY, ENVIRONMENTAL, AND OTHER GROUPS, AND PUBLIC AT LARGE

The primary local sponsor for this project was the East Dakota Water Development District (EDWDD). EDWDD was the lead project sponsor of the Rotating Basins – Big Sioux River Assessment Project (2020-2021). EDWDD provided staff, financial, and technical assistance. Other local sponsors of implementation projects include the Big Sioux River Project, and the Prairie Coteau Watershed Improvement and Protection Project. Project personnel frequently collaborated with landowners, addressed their concerns, and elaborated on implementation projects that would be suitable for water quality improvements.

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Appendix A – Measured Discharge and TSS Data

Observed TSS Loading BIG SIOUX 05								
SampleDate	Segment	StationID	Project	TSS Value (mg/L)	Discharge (cfs)	Discharge (MGD)	Flow Frequency Percentage	Observed Loading (Ton/day)
09/16/2019	5	CENTBSRR01	EDWQSPZ1	13	5285.32	3415.90	0.33%	1.85E+02
04/25/2001	5	460662	AMBIENT	22	5189.08	3353.70	0.36%	3.08E+02
04/09/2001	5	NCENBSRR01	NCENBSR1	56	4435.18	2866.46	0.69%	6.70E+02
04/13/2001	5	NCENBSRR01	NCENBSR1	37	4363.00	2819.80	0.77%	4.35E+02
04/23/2018	5	460662	Ambient	40	4218.63	2726.50	0.92%	4.55E+02
07/15/2019	5	CENTBSRR01	EDWQSPZ1	8	4130.41	2669.48	1.05%	8.91E+01
05/21/2019	5	CENTBSRR01	EDWQSPZ1	6	4026.15	2602.10	1.15%	6.51E+01
04/16/2019	5	460662	Ambient	14	3841.68	2482.88	1.34%	1.45E+02
07/16/2019	5	460662	Ambient	12	3641.18	2353.29	1.57%	1.18E+02
06/16/2010	5	460662	AMBIENT	14	3512.85	2270.36	1.67%	1.33E+02
03/12/2020	5	460662	Ambient	105	3496.81	2259.99	1.71%	9.90E+02
03/23/2010	5	460662	AMBIENT	28	3392.55	2192.61	1.78%	2.56E+02
05/08/2001	5	NCENBSRR01	NCENBSR1	14	3095.80	2000.82	2.03%	1.17E+02
06/03/2019	5	CENTBSRR01	EDWQSPZ1	3	2694.79	1741.64	2.72%	2.18E+01
09/23/2019	5	CENTBSRR01	EDWQSPZ1	25	2454.19	1586.14	3.20%	1.65E+02
07/24/2018	5	460662	Ambient	127	2301.80	1487.65	3.62%	7.88E+02
05/11/2011	5	460662	Ambient	11	2293.78	1482.47	3.63%	6.80E+01
04/18/2023	5	460662	Ambient	52	2261.70	1461.74	3.74%	3.17E+02
08/19/2019	5	CENTBSRR01	EDWQSPZ1	39	2053.18	1326.97	4.29%	2.16E+02
03/21/2007	5	460662	AMBIENT	75	2029.11	1311.42	4.37%	4.10E+02
05/09/2012	5	460662	Ambient	204	1972.97	1275.13	4.58%	1.09E+03
04/07/2020	5	460662	Ambient	36	1972.97	1275.13	4.61%	1.92E+02
10/07/2019	5	CENTBSRR01	EDWQSPZ1	32	1908.81	1233.66	4.85%	1.65E+02
10/16/2019	5	460662	Ambient	27	1828.61	1181.83	5.25%	1.33E+02
10/10/2017	5	CENTBSRR01	EDWQSPZ1	35	1772.47	1145.55	5.58%	1.67E+02
06/15/2001	5	NCENBSRR01	NCENBSR1	28	1756.43	1135.18	5.73%	1.33E+02
06/17/2019	5	CENTBSRR01	EDWQSPZ1	13	1748.41	1130.00	5.81%	6.13E+01
07/06/2011	5	460662	Ambient	49	1724.35	1114.44	5.91%	2.28E+02
07/14/2010	5	460662	AMBIENT	17	1660.18	1072.98	6.26%	7.61E+01
05/09/2018	5	CENTBSRR01	EDWQSPZ1	40	1636.12	1057.43	6.46%	1.76E+02
06/14/2011	5	CENTBSRR01	EDWQSPZ1	9	1620.08	1047.06	6.56%	3.93E+01
06/15/2011	5	460662	Ambient	14	1588.00	1026.33	6.89%	5.99E+01
07/01/2019	5	CENTBSRR01	EDWQSPZ1	16	1571.96	1015.96	7.01%	6.78E+01
06/25/2013	5	CENTBSRR01	EDWQSPZ1	80	1475.72	953.76	7.55%	3.18E+02
05/16/2018	5	460662	Ambient	43	1475.72	953.76	7.56%	1.71E+02
05/23/2001	5	460662	AMBIENT	25	1443.64	933.02	7.70%	9.73E+01
04/14/2010	5	460662	AMBIENT	12	1443.64	933.02	7.72%	4.67E+01
03/19/2019	5	460662	Ambient	17	1435.62	927.84	7.77%	6.58E+01
05/06/2020	5	460662	Ambient	37	1323.34	855.27	8.60%	1.32E+02

05/24/2017	5	CENTBSRR01	EDWQSPZ1	52	1315.32	850.09	8.65%	1.84E+02
06/04/2014	5	460662	Ambient	150	1243.13	803.44	9.21%	5.03E+02
08/14/2019	5	460662	Ambient	68	1203.03	777.52	9.56%	2.21E+02
06/25/2001	5	460662	AMBIENT	72	1178.97	761.97	9.71%	2.29E+02
05/09/2002	5	NCENBSRR01	NCENBSR1	182	1130.85	730.87	9.99%	5.55E+02
03/21/2018	5	460662	Ambient	15	1074.71	694.58	10.46%	4.35E+01
05/12/2022	5	460662	Ambient	166	1066.69	689.40	10.60%	4.77E+02
07/05/2018	5	CENTBSRR01	EDWQSPZ1	132	1034.61	668.67	10.90%	3.68E+02
09/04/2019	5	460662	Ambient	112	1034.61	668.67	10.91%	3.12E+02
05/18/2010	5	460662	AMBIENT	13	1026.59	663.48	10.94%	3.60E+01
07/27/2011	5	CENTBSRR01	EDWQSPZ1	128	1026.59	663.48	10.97%	3.54E+02
12/18/2019	5	460662	Ambient	16	1026.59	663.48	11.01%	4.43E+01
05/24/2018	5	CENTBSRR01	EDWQSPZ1	31	1010.55	653.12	11.24%	8.45E+01
09/26/2018	5	CENTBSRR01	EDWQSPZ1	76	994.51	642.75	11.53%	2.04E+02
04/16/2007	5	460662	AMBIENT	41	978.47	632.38	11.65%	1.08E+02
09/26/2017	5	CENTBSRR01	EDWQSPZ1	206	970.45	627.20	11.87%	5.39E+02
07/25/2001	5	NCENBSRR01	NCENBSR1	72	962.43	622.02	11.92%	1.87E+02
09/14/2010	5	460662	Ambient	89	954.41	616.83	12.08%	2.29E+02
06/02/2020	5	460662	Ambient	153	930.34	601.28	12.43%	3.84E+02
06/08/2022	5	460662	Ambient	100	922.32	596.10	12.54%	2.49E+02
06/18/2008	5	460662	AMBIENT	76	914.30	590.92	12.57%	1.87E+02
05/23/2022	5	CENTBSRR01	EDWQSPZ1	89	882.22	570.18	13.11%	2.12E+02
08/03/2011	5	460662	Ambient	180	874.20	565.00	13.19%	4.24E+02
08/29/2017	5	CENTBSRR01	EDWQSPZ1	88	866.18	559.81	13.26%	2.06E+02
04/12/2006	5	460662	AMBIENT	74	858.16	554.63	13.34%	1.71E+02
06/17/2014	5	CENTBSRR01	EDWQSPZ1	140	858.16	554.63	13.42%	3.24E+02
08/16/2010	5	460662	Ambient	95	842.12	544.26	13.61%	2.16E+02
01/07/2020	5	460662	Ambient	13	842.12	544.26	13.69%	2.95E+01
10/17/2018	5	CENTBSRR01	EDWQSPZ1	49	834.10	539.08	13.76%	1.10E+02
11/14/2019	5	460662	Ambient	16	834.10	539.08	13.77%	3.60E+01
07/24/2001	5	460662	AMBIENT	118	826.08	533.90	13.83%	2.63E+02
04/15/2009	5	460662	AMBIENT	60	826.08	533.90	13.87%	1.34E+02
05/16/2007	5	460662	AMBIENT	34	798.81	516.27	14.37%	7.32E+01
04/15/2021	5	460662	Ambient	166	786.78	508.50	14.59%	3.52E+02
06/20/2016	5	460662	Ambient	120	783.58	506.42	14.67%	2.54E+02
06/08/2020	5	CENTBSRR01	RTBNRIST	280	776.36	501.76	14.82%	5.86E+02
10/19/2010	5	460662	Ambient	35	767.53	496.06	14.98%	7.24E+01
05/15/2002	5	460662	AMBIENT	116	766.73	495.54	14.99%	2.40E+02
06/15/2005	5	460662	AMBIENT	79	763.52	493.47	15.06%	1.63E+02
05/10/2023	5	460662	Ambient	84	758.71	490.36	15.13%	1.72E+02
04/16/2021	5	CENTBSRR01	RTBNRIST	134	725.83	469.10	15.61%	2.62E+02
03/25/2021	5	CENTBSRR01	RTBNRIST	154	724.23	468.07	15.67%	3.01E+02
05/14/2014	5	460662	Ambient	75	710.59	459.25	15.94%	1.44E+02
03/19/2003	5	460662	AMBIENT	260	700.16	452.52	16.20%	4.91E+02
11/15/2010	5	460662	Ambient	22	683.32	441.63	16.54%	4.05E+01
03/09/2016	5	460662	Ambient	134	678.51	438.52	16.63%	2.45E+02
06/17/2013	5	460662	Ambient	150	659.26	426.08	17.08%	2.67E+02
04/09/2014	5	460662	Ambient	198	656.05	424.01	17.17%	3.50E+02
10/24/2017	5	460662	Ambient	48	652.85	421.93	17.33%	8.45E+01
02/11/2020	5	460662	Ambient	6	652.85	421.93	17.38%	1.06E+01

05/21/2008	5	460662	AMBIENT	37	650.44	420.38	17.50%	6.49E+01
06/13/2022	5	CENTBSRR01	EDWQSPZ1	163	649.64	419.86	17.56%	2.86E+02
07/10/2013	5	460662	QC	119	633.60	409.49	18.06%	2.03E+02
10/25/2017	5	CENTBSRR01	EDWQSPZ1	35	630.39	407.42	18.12%	5.95E+01
06/22/2020	5	CENTBSRR01	RTBNRIST	226	612.74	396.02	18.50%	3.73E+02
05/22/2023	5	CENTBSRR01	EDWQSPZ1	94	602.32	389.28	18.84%	1.53E+02
06/22/2016	5	CENTBSRR01	EDWQSPZ1	88	599.11	387.20	18.92%	1.42E+02
04/19/2021	5	CENTBSRR01	RTBNRIST	186	596.70	385.65	18.99%	2.99E+02
08/26/2015	5	CENTBSRR01	EDWQSPZ1	79	579.06	374.25	19.48%	1.23E+02
08/15/2016	5	460662	Ambient	169	575.05	371.65	19.57%	2.62E+02
06/06/2007	5	460662	AMBIENT	31	573.45	370.62	19.61%	4.79E+01
10/23/2018	5	460662	Ambient	45	572.64	370.10	19.64%	6.95E+01
04/08/2002	5	NCENBSRR01	NCENBSR1	160	546.98	353.51	20.44%	2.36E+02
05/29/2013	5	CENTBSRR01	EDWQSPZ1	63	546.98	353.51	20.48%	9.29E+01
05/06/2009	5	460662	AMBIENT	27	529.33	342.11	21.06%	3.85E+01
08/22/2011	5	CENTBSRR01	EDWQSPZ1	122	527.73	341.07	21.14%	1.74E+02
05/10/2006	5	460662	AMBIENT	48	526.13	340.04	21.20%	6.81E+01
06/19/2018	5	CENTBSRR01	EDWQSPZ1	178	526.13	340.04	21.22%	2.53E+02
07/02/2014	5	CENTBSRR01	EDWQSPZ1	120	525.32	339.52	21.24%	1.70E+02
08/13/2014	5	460662	Ambient	178	509.28	329.15	21.82%	2.44E+02
05/15/2013	5	460662	Ambient	105	504.47	326.04	21.99%	1.43E+02
07/20/2016	5	CENTBSRR01	EDWQSPZ1	44	498.06	321.89	22.24%	5.91E+01
04/11/2017	5	460662	QC	43	494.85	319.82	22.32%	5.74E+01
06/06/2018	5	460662	Ambient	156	494.05	319.30	22.40%	2.08E+02
05/15/2012	5	CENTBSRR01	EDWQSPZ1	144	485.22	313.60	22.70%	1.88E+02
03/21/2012	5	460662	AMBIENT	89	483.62	312.56	22.79%	1.16E+02
05/01/2002	5	NCENBSRR01	NCENBSR1	130	481.21	311.01	22.90%	1.69E+02
03/19/2014	5	460662	Ambient	37	481.21	311.01	22.97%	4.80E+01
07/09/2015	5	460662	Ambient	188	471.59	304.79	23.32%	2.39E+02
05/21/2014	5	CENTBSRR01	EDWQSPZ1	38	470.79	304.27	23.37%	4.82E+01
10/31/2018	5	CENTBSRR01	EDWQSPZ1	32	467.58	302.20	23.48%	4.03E+01
08/12/2015	5	460662	Ambient	156	461.16	298.05	23.78%	1.94E+02
04/25/2013	5	CENTBSRR01	EDWQSPZ1	108	460.36	297.53	23.80%	1.34E+02
10/12/2016	5	460662	Ambient	44	453.94	293.38	24.13%	5.39E+01
07/11/2022	5	CENTBSRR01	EDWQSPZ1	193	451.54	291.83	24.23%	2.35E+02
11/08/2017	5	CENTBSRR01	EDWQSPZ1	51	445.12	287.68	24.50%	6.12E+01
03/08/2017	5	460662	Ambient	76	429.08	277.32	25.02%	8.79E+01
04/26/2017	5	CENTBSRR01	EDWQSPZ1	28	427.48	276.28	25.05%	3.23E+01
07/06/2020	5	CENTBSRR01	RTBNRIST	202	427.48	276.28	25.07%	2.33E+02
06/21/2017	5	CENTBSRR01	EDWQSPZ1	82	416.25	269.02	25.52%	9.20E+01
08/01/2018	5	CENTBSRR01	EDWQSPZ1	84	413.04	266.95	25.65%	9.36E+01
03/28/2006	5	460662	AMBIENT	68	411.44	265.91	25.70%	7.54E+01
06/02/2000	5	CENTBSRR01	CENTBSR1	140	410.64	265.39	25.77%	1.55E+02
10/13/2005	5	460662	QC	76	401.01	259.17	26.07%	8.22E+01
06/12/2017	5	460662	Ambient	142	401.01	259.17	26.15%	1.54E+02
05/10/2017	5	460662	AMBIENT	87	399.41	258.14	26.23%	9.37E+01
04/22/2002	5	460662	AMBIENT	61	398.60	257.62	26.24%	6.56E+01
06/07/2017	5	CENTBSRR01	EDWQSPZ1	100	394.59	255.03	26.44%	1.06E+02
11/14/2018	5	460662	Ambient	31	392.99	253.99	26.56%	3.28E+01
06/03/2015	5	460662	Ambient	156	385.77	249.32	26.80%	1.62E+02

04/16/2008	5	460662	AMBIENT	128	382.56	247.25	26.95%	1.32E+02
06/08/2016	5	CENTBSRR01	EDWQSPZ1	101	381.76	246.73	26.99%	1.04E+02
08/17/2016	5	CENTBSRR01	EDWQSPZ1	90	380.96	246.21	27.03%	9.24E+01
05/03/2021	5	CENTBSRR01	RTBNRIST	216	380.16	245.70	27.08%	2.21E+02
03/09/2021	5	CENTBSRR01	RTBNRIST	204	372.14	240.51	27.37%	2.05E+02
05/11/2017	5	CENTBSRR01	EDWQSPZ1	67	370.53	239.48	27.45%	6.69E+01
08/08/2018	5	460662	Ambient	94	370.53	239.48	27.47%	9.39E+01
04/24/2012	5	CENTBSRR01	EDWQSPZ1	92	369.73	238.96	27.49%	9.17E+01
07/16/2014	5	460662	Ambient	90	369.73	238.96	27.50%	8.97E+01
05/12/2016	5	CENTBSRR01	EDWQSPZ1	126	368.93	238.44	27.60%	1.25E+02
11/18/2009	5	460662	AMBIENT	31	368.13	237.92	27.64%	3.08E+01
12/08/2010	5	460662	QC	13	360.91	233.26	28.03%	1.27E+01
06/06/2012	5	460662	Ambient	194	359.31	232.22	28.17%	1.88E+02
08/21/2001	5	460662	AMBIENT	132	356.90	230.66	28.24%	1.27E+02
05/18/2005	5	460662	AMBIENT	34	356.90	230.66	28.26%	3.27E+01
05/20/2015	5	460662	Ambient	121	350.48	226.52	28.57%	1.14E+02
04/27/2016	5	CENTBSRR01	EDWQSPZ1	97	347.28	224.44	28.76%	9.08E+01
12/11/2017	5	460662	Ambient	21	345.67	223.41	28.84%	1.96E+01
04/06/2016	5	460662	Ambient	67	343.27	221.85	29.07%	6.20E+01
05/11/2016	5	460662	Ambient	136	343.27	221.85	29.09%	1.26E+02
07/18/2018	5	CENTBSRR01	EDWQSPZ1	170	340.86	220.30	29.25%	1.56E+02
11/02/2021	5	460662	Ambient	88	339.26	219.26	29.36%	8.05E+01
04/13/2005	5	460662	QC	124	337.65	218.22	29.42%	1.13E+02
09/12/2011	5	CENTBSRR01	EDWQSPZ1	108	335.24	216.67	29.57%	9.76E+01
04/15/2013	5	460662	QC	264	332.04	214.60	29.73%	2.36E+02
09/14/2011	5	460662	Ambient	120	319.20	206.30	30.55%	1.03E+02
04/04/2012	5	460662	Ambient	116	319.20	206.30	30.56%	9.98E+01
11/16/2017	5	460662	Ambient	38	316.80	204.75	30.75%	3.25E+01
10/18/2016	5	CENTBSRR01	EDWQSPZ1	43	316.00	204.23	30.83%	3.66E+01
07/14/2020	5	460662	Ambient	272	311.99	201.64	31.15%	2.29E+02
08/02/2017	5	CENTBSRR01	EDWQSPZ1	148	307.98	199.05	31.38%	1.23E+02
08/28/2001	5	NCENBSRR01	NCENBSR1	107	306.37	198.01	31.47%	8.84E+01
10/26/2009	5	460662	AMBIENT	47	300.76	194.38	31.88%	3.81E+01
04/12/2022	5	460662	Ambient	124	299.15	193.34	32.05%	1.00E+02
05/12/2021	5	460662	Ambient	132	295.95	191.27	32.28%	1.05E+02
07/14/2000	5	CENTBSRR01	CENTBSR1	314	288.73	186.60	32.64%	2.44E+02
07/06/2022	5	460662	Ambient	144	287.93	186.09	32.81%	1.12E+02
09/06/2017	5	460662	Ambient	47	286.32	185.05	32.89%	3.63E+01
06/16/2004	5	460662	AMBIENT	116	281.51	181.94	33.05%	8.81E+01
08/27/2014	5	CENTBSRR01	EDWQSPZ1	68	275.09	177.79	33.62%	5.04E+01
04/12/2016	5	CENTBSRR01	EDWQSPZ1	36	272.69	176.24	33.78%	2.65E+01
09/21/2005	5	460662	AMBIENT	158	270.28	174.68	33.96%	1.15E+02
07/30/2013	5	CENTBSRR01	EDWQSPZ1	114	268.68	173.65	34.05%	8.26E+01
09/13/2016	5	CENTBSRR01	EDWQSPZ1	36	268.68	173.65	34.06%	2.61E+01
12/10/2018	5	460662	Ambient	10	264.67	171.05	34.47%	7.14E+00
09/17/2001	5	460662	AMBIENT	98	256.65	165.87	35.09%	6.78E+01
07/29/2015	5	CENTBSRR01	EDWQSPZ1	178	253.44	163.80	35.51%	1.22E+02
08/03/2020	5	CENTBSRR01	RTBNRIST	170	252.64	163.28	35.57%	1.16E+02
09/10/2018	5	460662	Ambient	98	251.83	162.76	35.61%	6.65E+01
07/22/2009	5	460662	AMBIENT	188	251.03	162.24	35.69%	1.27E+02

07/20/2020	5	CENTBSRR01	RTBNRIST	204	249.43	161.21	35.78%	1.37E+02
07/01/2015	5	CENTBSRR01	EDWQSPZ1	138	248.63	160.69	35.88%	9.25E+01
05/24/2000	5	460662	AMBIENT	206	245.42	158.61	36.18%	1.36E+02
08/28/2018	5	CENTBSRR01	EDWQSPZ1	92	245.42	158.61	36.24%	6.09E+01
03/26/2008	5	460662	AMBIENT	22	240.61	155.50	36.56%	1.43E+01
03/16/2011	5	460662	Ambient	7	240.61	155.50	36.71%	4.54E+00
08/12/2020	5	460662	Ambient	236	234.99	151.88	37.34%	1.50E+02
10/19/2011	5	460662	QC	19	228.58	147.73	37.81%	1.17E+01
08/07/2013	5	460662	Ambient	97	227.77	147.21	37.88%	5.96E+01
08/13/2013	5	CENTBSRR01	EDWQSPZ1	55	222.16	143.58	38.55%	3.29E+01
05/25/2016	5	CENTBSRR01	EDWQSPZ1	82	219.75	142.03	38.77%	4.86E+01
01/20/2011	5	460662	Ambient	10	216.55	139.95	39.08%	5.84E+00
05/25/2021	5	CENTBSRR01	RTBNRIST	252	214.14	138.40	39.37%	1.46E+02
12/12/2016	5	460662	QC	7	212.54	137.36	39.54%	4.01E+00
09/26/2001	5	NCENBSRR01	NCENBSR1	40	210.93	136.33	39.58%	2.27E+01
09/15/2016	5	460662	Ambient	81	210.93	136.33	39.63%	4.61E+01
02/09/2011	5	460662	Ambient	6	208.53	134.77	39.94%	3.37E+00
09/12/2018	5	CENTBSRR01	EDWQSPZ1	88	206.92	133.73	40.21%	4.91E+01
11/09/2011	5	460662	Ambient	8	204.52	132.18	40.47%	4.41E+00
11/02/2016	5	CENTBSRR01	EDWQSPZ1	22	204.52	132.18	40.49%	1.21E+01
06/03/2021	5	460662	Ambient	292	204.52	132.18	40.51%	1.61E+02
06/28/2000	5	CENTBSRR01	CENTBSR1	208	203.71	131.66	40.52%	1.14E+02
10/16/2007	5	460662	AMBIENT	73	201.31	130.10	40.76%	3.96E+01
04/21/2003	5	460662	AMBIENT	90	199.70	129.07	41.11%	4.85E+01
05/14/2003	5	460662	AMBIENT	74	198.90	128.55	41.19%	3.97E+01
06/24/2009	5	460662	AMBIENT	140	198.10	128.03	41.24%	7.48E+01
09/10/2014	5	CENTBSRR01	EDWQSPZ1	45	198.10	128.03	41.26%	2.40E+01
08/15/2018	5	CENTBSRR01	EDWQSPZ1	102	192.49	124.40	41.81%	5.29E+01
09/28/2016	5	CENTBSRR01	EDWQSPZ1	39	184.46	119.22	42.57%	1.94E+01
10/13/2021	5	460662	Ambient	290	182.86	118.18	42.77%	1.43E+02
09/12/2017	5	CENTBSRR01	EDWQSPZ1	15	174.04	112.48	43.86%	7.04E+00
07/14/2004	5	460662	AMBIENT	100	173.24	111.96	43.93%	4.67E+01
11/09/2016	5	460662	Ambient	16	173.24	111.96	43.96%	7.47E+00
11/17/2020	5	460662	Ambient	47	172.43	111.44	44.10%	2.19E+01
09/27/2006	5	460662	AMBIENT	76	171.63	110.93	44.14%	3.52E+01
07/05/2017	5	CENTBSRR01	EDWQSPZ1	60	171.63	110.93	44.20%	2.78E+01
01/10/2019	5	460662	Ambient	4	171.63	110.93	44.21%	1.85E+00
08/13/2008	5	460662	AMBIENT	232	170.03	109.89	44.43%	1.06E+02
06/17/2015	5	CENTBSRR01	EDWQSPZ1	140	166.82	107.82	44.96%	6.30E+01
08/14/2017	5	460662	Ambient	170	163.61	105.74	45.47%	7.50E+01
08/16/2017	5	CENTBSRR01	EDWQSPZ1	128	162.81	105.22	45.58%	5.62E+01
10/06/2004	5	460662	AMBIENT	45	162.01	104.71	45.68%	1.97E+01
06/11/2002	5	NCENBSRR01	NCENBSR1	154	161.21	104.19	45.77%	6.69E+01
07/17/2017	5	460662	Ambient	228	161.21	104.19	45.87%	9.91E+01
06/07/2021	5	CENTBSRR01	RTBNRIST	267	161.21	104.19	45.90%	1.16E+02
05/25/2004	5	460662	AMBIENT	34	159.60	103.15	46.20%	1.46E+01
02/14/2017	5	460662	AMBIENT	11	158.80	102.63	46.37%	4.71E+00
06/27/2000	5	460662	AMBIENT	280	157.20	101.60	46.48%	1.19E+02
07/30/2014	5	CENTBSRR01	EDWQSPZ1	102	157.20	101.60	46.56%	4.32E+01
08/17/2020	5	CENTBSRR01	RTBNRIST	182	157.20	101.60	46.58%	7.71E+01

07/15/2015	5	CENTBSRR01	EDWQSPZ1	82	156.39	101.08	46.68%	3.46E+01
11/16/2016	5	CENTBSRR01	EDWQSPZ1	7	155.59	100.56	46.80%	2.94E+00
06/26/2023	5	CENTBSRR01	EDWQSPZ1	71	153.19	99.00	47.19%	2.93E+01
12/09/2015	5	460662	Ambient	10	152.38	98.49	47.36%	4.11E+00
06/13/2023	5	460662	Ambient	92	149.98	96.93	47.64%	3.72E+01
06/25/2002	5	460662	AMBIENT	148	147.57	95.38	47.97%	5.89E+01
10/18/2021	5	CENTBSRR01	RTBNRIST	132	147.57	95.38	48.09%	5.25E+01
06/19/2012	5	CENTBSRR01	EDWQSPZ1	184	145.97	94.34	48.33%	7.24E+01
09/08/2015	5	CENTBSRR01	EDWQSPZ1	84	145.17	93.82	48.44%	3.29E+01
10/23/2001	5	NCENBSRR01	NCENBSR1	9	144.36	93.30	48.50%	3.50E+00
11/28/2001	5	460662	AMBIENT	13	144.36	93.30	48.52%	5.06E+00
12/17/2001	5	460662	AMBIENT	22	144.36	93.30	48.54%	8.56E+00
02/27/2002	5	460662	AMBIENT	35	144.36	93.30	48.59%	1.36E+01
11/06/2007	5	460662	AMBIENT	22	141.96	91.75	49.13%	8.42E+00
10/29/2001	5	460662	AMBIENT	7	141.16	91.23	49.24%	2.66E+00
11/19/2008	5	460662	AMBIENT	19	140.35	90.71	49.51%	7.19E+00
05/06/2015	5	CENTBSRR01	EDWQSPZ1	65	140.35	90.71	49.58%	2.46E+01
03/28/2000	5	460662	AMBIENT	50	137.15	88.64	50.10%	1.85E+01
02/13/2019	5	460662	Ambient	5	137.15	88.64	50.21%	1.85E+00
07/19/2017	5	CENTBSRR01	EDWQSPZ1	138	133.94	86.56	50.92%	4.98E+01
11/30/2005	5	460662	AMBIENT	10	132.33	85.53	51.16%	3.57E+00
07/15/2008	5	460662	AMBIENT	108	131.53	85.01	51.35%	3.83E+01
10/16/2013	5	CENTBSRR01	EDWQSPZ1	20	131.53	85.01	51.38%	7.09E+00
11/16/2004	5	460662	AMBIENT	16	129.93	83.97	51.66%	5.61E+00
08/30/2016	5	CENTBSRR01	EDWQSPZ1	92	129.93	83.97	51.75%	3.22E+01
09/03/2020	5	460662	Ambient	129	128.32	82.94	52.33%	4.46E+01
09/22/2014	5	CENTBSRR01	EDWQSPZ1	32	124.31	80.34	53.25%	1.07E+01
12/09/2020	5	460662	Ambient	32	122.71	79.31	53.74%	1.06E+01
12/22/2021	5	460662	Ambient	9	121.91	78.79	53.95%	2.96E+00
01/07/2016	5	460662	Ambient	3	120.30	77.75	54.44%	9.73E-01
06/14/2006	5	460662	AMBIENT	124	119.50	77.23	54.54%	4.00E+01
04/15/2015	5	460662	Ambient	98	119.50	77.23	54.61%	3.16E+01
11/18/2013	5	460662	Ambient	12	117.10	75.68	55.24%	3.79E+00
01/11/2006	5	460662	AMBIENT	8	116.29	75.16	55.42%	2.51E+00
12/21/2009	5	460662	AMBIENT	9	116.29	75.16	55.57%	2.82E+00
09/08/2020	5	CENTBSRR01	RTBNRIST	64	114.69	74.12	56.01%	1.98E+01
02/15/2006	5	460662	AMBIENT	6	113.09	73.09	56.31%	1.83E+00
08/08/2022	5	460662	Ambient	102	112.28	72.57	56.92%	3.09E+01
04/27/2000	5	460662	AMBIENT	72	111.48	72.05	56.94%	2.16E+01
07/07/2016	5	CENTBSRR01	EDWQSPZ1	94	111.48	72.05	57.08%	2.83E+01
08/03/2016	5	CENTBSRR01	EDWQSPZ1	86	109.88	71.01	57.38%	2.55E+01
01/19/2017	5	460662	AMBIENT	7	109.88	71.01	57.40%	2.07E+00
09/21/2020	5	CENTBSRR01	RTBNRIST	42	108.27	69.98	58.00%	1.23E+01
09/14/2015	5	460662	Ambient	86	105.06	67.90	58.53%	2.44E+01
10/07/2020	5	460662	Ambient	20	104.26	67.39	59.02%	5.62E+00
03/29/2005	5	460662	AMBIENT	16	102.66	66.35	59.23%	4.43E+00
07/06/2016	5	460662	Ambient	82	100.25	64.79	60.18%	2.22E+01
01/09/2012	5	460662	Ambient	8	99.45	64.27	60.31%	2.15E+00
02/26/2018	5	460662	Ambient	7	98.65	63.76	60.50%	1.86E+00
10/08/2014	5	CENTBSRR01	EDWQSPZ1	13	97.85	63.24	60.70%	3.43E+00

12/21/2005	5	460662	AMBIENT	7	96.24	62.20	61.09%	1.82E+00
08/17/2009	5	460662	AMBIENT	106	95.44	61.68	61.67%	2.73E+01
12/14/2011	5	460662	Ambient	4	95.44	61.68	61.69%	1.03E+00
11/04/2015	5	460662	Ambient	15	94.64	61.16	61.95%	3.83E+00
08/09/2023	5	460662	Ambient	144	94.64	61.16	61.99%	3.67E+01
12/18/2020	5	CENTBSRR01	RTBNRIST	18	93.03	60.13	62.39%	4.52E+00
07/20/2005	5	460662	AMBIENT	196	92.23	59.61	62.46%	4.87E+01
07/11/2007	5	460662	AMBIENT	252	92.23	59.61	62.48%	6.27E+01
01/14/2010	5	460662	AMBIENT	160	92.23	59.61	62.56%	3.98E+01
11/17/2015	5	CENTBSRR01	EDWQSPZ1	9	92.23	59.61	62.77%	2.24E+00
02/15/2012	5	460662	Ambient	9	91.43	59.09	63.02%	2.22E+00
01/11/2021	5	460662	Ambient	6	91.43	59.09	63.26%	1.48E+00
10/19/2020	5	CENTBSRR01	RTBNRIST	8	90.63	58.57	63.59%	1.95E+00
10/16/2008	5	460662	AMBIENT	16	89.02	57.54	64.05%	3.84E+00
12/22/2020	5	CENTBSRR01	RTBNRIST	13	89.02	57.54	64.19%	3.12E+00
09/11/2013	5	460662	Ambient	47	88.22	57.02	64.54%	1.12E+01
03/31/2004	5	460662	AMBIENT	17	87.42	56.50	64.74%	4.01E+00
11/06/2014	5	460662	QC	8	85.82	55.46	65.26%	1.85E+00
07/11/2023	5	460662	QC	40	85.82	55.46	65.32%	9.26E+00
02/02/2021	5	460662	Ambient	3	82.61	53.39	66.08%	6.68E-01
09/18/2013	5	CENTBSRR01	EDWQSPZ1	57	81.00	52.35	66.36%	1.24E+01
10/16/2006	5	460662	AMBIENT	134	79.72	51.52	66.98%	2.88E+01
08/15/2022	5	CENTBSRR01	EDWQSPZ1	44	78.04	50.44	67.45%	9.26E+00
06/11/2003	5	460662	AMBIENT	80	76.91	49.71	67.80%	1.66E+01
10/09/2013	5	460662	Ambient	22	75.87	49.04	68.38%	4.50E+00
07/09/2012	5	460662	QC	118	74.99	48.47	68.61%	2.39E+01
09/19/2007	5	460662	AMBIENT	79	74.27	48.00	68.84%	1.58E+01
07/17/2023	5	CENTBSRR01	EDWQSPZ1	42	73.55	47.53	68.99%	8.33E+00
12/15/2004	5	460662	AMBIENT	10	73.22	47.33	69.09%	1.97E+00
01/27/2002	5	460662	AMBIENT	9	72.18	46.65	69.32%	1.75E+00
12/05/2007	5	460662	AMBIENT	3	72.18	46.65	69.47%	5.84E-01
03/11/2015	5	460662	Ambient	10	72.18	46.65	69.60%	1.95E+00
06/23/2021	5	CENTBSRR01	RTBNRIST	44	71.86	46.44	69.76%	8.53E+00
09/23/2015	5	CENTBSRR01	EDWQSPZ1	38	71.62	46.29	69.84%	7.34E+00
08/16/2007	5	460662	AMBIENT	148	70.34	45.46	70.20%	2.81E+01
10/07/2015	5	CENTBSRR01	EDWQSPZ1	20	69.21	44.73	70.39%	3.73E+00
07/27/2000	5	460662	AMBIENT	124	68.97	44.58	70.41%	2.31E+01
02/24/2000	5	460662	AMBIENT	8	68.17	44.06	70.63%	1.47E+00
02/11/2015	5	460662	Ambient	6	67.37	43.54	71.02%	1.09E+00
07/12/2021	5	CENTBSRR01	RTBNRIST	4	63.68	41.16	72.14%	6.87E-01
09/15/2009	5	460662	AMBIENT	46	62.08	40.12	72.54%	7.70E+00
01/22/2015	5	460662	Ambient	4	60.95	39.39	72.75%	6.57E-01
10/19/2015	5	460662	Ambient	10	60.63	39.19	72.94%	1.63E+00
10/21/2015	5	CENTBSRR01	EDWQSPZ1	10	60.15	38.88	73.13%	1.62E+00
09/25/2008	5	460662	AMBIENT	106	58.87	38.05	73.48%	1.68E+01
11/02/2000	5	CENTBSRR01	CENTBSR1	61	56.94	36.80	73.93%	9.37E+00
10/08/2002	5	460662	AMBIENT	24	56.22	36.34	74.11%	3.64E+00
09/09/2021	5	460662	Ambient	132	56.22	36.34	74.12%	2.00E+01
12/15/2006	5	460662	AMBIENT	9	56.14	36.28	74.27%	1.36E+00
01/11/2022	5	460662	Ambient	6	55.10	35.61	74.77%	8.91E-01

02/23/2021	5	CENTBSRR01	RTBNRIST	5	54.94	35.51	74.81%	7.41E-01
08/16/2006	5	460662	AMBIENT	144	54.62	35.30	74.90%	2.12E+01
08/10/2000	5	460662	AMBIENT	112	54.54	35.25	74.93%	1.65E+01
12/17/2008	5	460662	QC	5	54.54	35.25	74.96%	7.35E-01
09/20/2021	5	CENTBSRR01	RTBNRIST	72	54.38	35.14	75.05%	1.06E+01
08/16/2021	5	CENTBSRR01	RTBNRIST	204	54.06	34.94	75.09%	2.97E+01
07/09/2002	5	NCENBSRR01	NCENBSR1	129	52.53	33.95	75.52%	1.83E+01
09/01/2022	5	460662	Ambient	94	51.89	33.54	75.93%	1.32E+01
11/13/2023	5	460662	Ambient	3	51.89	33.54	75.95%	4.20E-01
09/14/2021	5	CENTBSRR01	RTBNRIST	74	51.57	33.33	76.00%	1.03E+01
04/14/2004	5	460662	AMBIENT	142	51.25	33.12	76.21%	1.96E+01
08/22/2002	5	NCENBSRR01	NCENBSR1	100	50.29	32.50	76.46%	1.36E+01
03/13/2002	5	460662	AMBIENT	9	48.12	31.10	76.90%	1.17E+00
07/07/2021	5	460662	Ambient	92	48.12	31.10	77.45%	1.19E+01
12/10/2014	5	460662	Ambient	4	44.91	29.03	78.50%	4.84E-01
01/09/2008	5	460662	AMBIENT	11	44.11	28.51	78.84%	1.31E+00
12/16/2013	5	460662	Ambient	6	43.79	28.30	79.07%	7.08E-01
07/19/2021	5	CENTBSRR01	RTBNRIST	54	42.27	27.32	79.58%	6.15E+00
08/06/2002	5	NCENBSRR01	NCENBSR1	78	41.38	26.75	79.91%	8.70E+00
11/13/2002	5	460662	AMBIENT	7	41.38	26.75	79.92%	7.81E-01
07/19/2006	5	460662	AMBIENT	112	40.82	26.38	80.11%	1.23E+01
12/11/2002	5	460662	AMBIENT	4	39.86	25.76	80.75%	4.30E-01
10/15/2002	5	NCENBSRR01	NCENBSR1	14	39.54	25.55	80.90%	1.49E+00
09/19/2022	5	CENTBSRR01	EDWQSPZ1	6	39.38	25.45	81.00%	6.37E-01
11/08/2022	5	460662	Ambient	14	38.58	24.93	81.35%	1.46E+00
07/26/2012	5	CENTBSRR01	EDWQSPZ1	118	37.29	24.10	81.87%	1.19E+01
08/08/2012	5	460662	Ambient	168	36.97	23.90	82.02%	1.67E+01
01/10/2007	5	460662	AMBIENT	2	36.89	23.84	82.08%	1.99E-01
10/11/2023	5	460662	Ambient	6	36.65	23.69	82.19%	5.93E-01
08/12/2002	5	460662	AMBIENT	174	35.85	23.17	82.55%	1.68E+01
08/31/2005	5	460662	AMBIENT	80	35.53	22.96	82.65%	7.66E+00
03/03/2022	5	460662	Ambient	66	35.13	22.70	82.84%	6.25E+00
01/20/2009	5	460662	AMBIENT	11	34.49	22.29	83.06%	1.02E+00
02/08/2022	5	460662	Ambient	7	34.33	22.19	83.15%	6.48E-01
08/11/2004	5	460662	AMBIENT	108	33.60	21.72	83.55%	9.79E+00
09/07/2023	5	460662	Ambient	66	32.96	21.30	83.74%	5.87E+00
09/11/2002	5	NCENBSRR01	NCENBSR1	98	30.64	19.80	85.14%	8.10E+00
07/21/2003	5	460662	AMBIENT	120	30.56	19.75	85.18%	9.89E+00
02/12/2009	5	460662	AMBIENT	9	30.48	19.70	85.33%	7.40E-01
09/09/2002	5	460662	AMBIENT	190	30.32	19.59	85.47%	1.55E+01
09/11/2023	5	CENTBSRR01	EDWQSPZ1	60	29.67	19.18	85.85%	4.80E+00
10/03/2022	5	460662	Ambient	30	29.27	18.92	85.98%	2.37E+00
01/25/2000	5	460662	AMBIENT	7	25.66	16.59	87.60%	4.84E-01
09/08/2004	5	460662	AMBIENT	98	25.50	16.48	87.82%	6.74E+00
08/02/2021	5	460662	Ambient	134	24.86	16.07	88.02%	8.98E+00
10/27/2000	5	CENTBSRR01	CENTBSR1	23	24.06	15.55	88.23%	1.49E+00
12/05/2012	5	460662	Ambient	10	24.06	15.55	88.49%	6.49E-01
10/24/2012	5	CENTBSRR01	EDWQSPZ1	43	23.82	15.39	88.64%	2.76E+00
10/24/2000	5	460662	AMBIENT	114	23.26	15.03	88.87%	7.15E+00
11/07/2012	5	460662	QC	15	23.18	14.98	88.98%	9.37E-01

01/15/2014	5	460662	Ambient	4	22.46	14.51	89.34%	2.42E-01
03/29/2001	5	460662	AMBIENT	4	21.65	14.00	89.72%	2.34E-01
02/16/2005	5	460662	AMBIENT	9	20.85	13.48	90.09%	5.06E-01
08/29/2012	5	CENTBSRR01	EDWQSPZ1	80	20.69	13.37	90.36%	4.46E+00
11/20/2003	5	460662	AMBIENT	20	20.37	13.17	90.42%	1.10E+00
12/07/2022	5	460662	Ambient	8	20.05	12.96	90.80%	4.33E-01
01/11/2023	5	460662	Ambient	3	18.93	12.23	91.36%	1.53E-01
09/12/2000	5	460662	AMBIENT	58	17.64	11.40	91.93%	2.76E+00
02/27/2007	5	460662	AMBIENT	7	16.84	10.89	92.44%	3.18E-01
02/21/2008	5	460662	AMBIENT	6	16.84	10.89	92.46%	2.72E-01
10/16/2012	5	460662	Ambient	35	16.60	10.73	92.54%	1.57E+00
11/28/2000	5	460662	AMBIENT	10	16.04	10.37	92.67%	4.33E-01
01/10/2005	5	460662	AMBIENT	7	16.04	10.37	92.71%	3.03E-01
08/20/2003	5	460662	AMBIENT	92	15.80	10.21	92.96%	3.92E+00
10/28/2003	5	460662	AMBIENT	50	14.68	9.49	93.61%	1.98E+00
12/02/2003	5	460662	AMBIENT	25	14.36	9.28	94.03%	9.68E-01
09/26/2012	5	CENTBSRR01	EDWQSPZ1	94	13.79	8.92	94.29%	3.50E+00
09/12/2012	5	460662	Ambient	120	13.47	8.71	94.59%	4.36E+00
03/21/2023	5	460662	Ambient	8	13.31	8.60	94.67%	2.87E-01
01/09/2013	5	460662	QC	7	12.83	8.29	95.15%	2.42E-01
02/19/2004	5	460662	AMBIENT	28	12.51	8.09	95.30%	9.45E-01
01/07/2004	5	460662	AMBIENT	11	10.83	7.00	96.41%	3.21E-01
02/27/2023	5	460662	Ambient	8	10.67	6.89	96.50%	2.30E-01
02/06/2013	5	460662	Ambient	7	8.02	5.18	97.50%	1.51E-01
02/12/2014	5	460662	Ambient	67	8.02	5.18	97.58%	1.45E+00
09/03/2003	5	460662	AMBIENT	62	7.82	5.05	97.65%	1.31E+00
01/28/2003	5	460662	AMBIENT	8	7.22	4.67	97.99%	1.56E-01
02/16/2003	5	460662	AMBIENT	10	6.42	4.15	98.51%	1.73E-01
03/26/2013	5	460662	Ambient	8	6.42	4.15	98.68%	1.38E-01
01/10/2001	5	460662	AMBIENT	6	4.81	3.11	99.32%	7.79E-02

Observed TSS Loading BIG SIOUX 06							
SampleDate	Segment	StationID	Project	TSS Value (mg/L)	Discharge (MGD)	Flow Frequency Percentage	Observed Loading (ton/day)
04/25/2001	6	460702	AMBIENT	13	3909.25	0.36%	2.12E+02
04/12/2011	6	460702	Ambient	6	3317.12	0.72%	8.30E+01
04/23/2018	6	460702	Ambient	10	3178.15	0.92%	1.33E+02
04/16/2019	6	460702	Ambient	6	2894.17	1.34%	7.24E+01
07/16/2019	6	460702	Ambient	5	2743.12	1.57%	5.72E+01
06/16/2010	6	460702	AMBIENT	6	2646.45	1.67%	6.62E+01
05/14/2019	6	460702	Ambient	1.5	2646.45	1.68%	1.66E+01
03/12/2020	6	460702	Ambient	31	2634.36	1.71%	3.41E+02
03/23/2010	6	460702	AMBIENT	7	2555.82	1.78%	7.46E+01
07/24/2018	6	460702	Ambient	8	1734.09	3.62%	5.79E+01
05/11/2011	6	460702	Ambient	10	1728.05	3.63%	7.21E+01
06/27/2013	6	BIGSIOUX01	BROOKSWS	20	1728.05	3.64%	1.44E+02
04/18/2023	6	460702	Ambient	4	1703.88	3.74%	2.84E+01
03/21/2007	6	460702	AMBIENT	28	1528.66	4.37%	1.79E+02
05/09/2012	6	460702	Ambient	67	1486.36	4.58%	4.15E+02
04/07/2020	6	460702	Ambient	19	1486.36	4.61%	1.18E+02
10/16/2019	6	460702	Ambient	16	1377.60	5.25%	9.20E+01
10/10/2017	6	CENTBSRR03	EDWQSPZ1	16	1335.31	5.58%	8.91E+01
07/06/2011	6	460702	Ambient	31	1299.06	5.91%	1.68E+02
05/10/2012	6	BIGSIOUX01	BROOKSWS	59	1274.89	6.09%	3.14E+02
07/14/2010	6	460702	AMBIENT	4	1250.72	6.26%	2.09E+01
05/09/2018	6	CENTBSRR03	EDWQSPZ1	13	1232.59	6.46%	6.69E+01
06/15/2011	6	460702	Ambient	19	1196.34	6.89%	9.48E+01
05/16/2018	6	460702	Ambient	23	1111.75	7.56%	1.07E+02
05/23/2001	6	460702	AMBIENT	19	1087.58	7.70%	8.62E+01
04/14/2010	6	460702	AMBIENT	6	1087.58	7.72%	2.72E+01
03/19/2019	6	460702	Ambient	109	1081.54	7.77%	4.92E+02
05/06/2020	6	460702	Ambient	17	996.95	8.60%	7.07E+01
05/24/2017	6	CENTBSRR03	EDWQSPZ1	30	990.91	8.65%	1.24E+02
06/04/2014	6	460702	Ambient	103	936.53	9.21%	4.02E+02
08/14/2019	6	460702	Ambient	48	906.32	9.56%	1.81E+02
06/25/2001	6	460702	AMBIENT	29	888.19	9.71%	1.07E+02
06/13/2013	6	BIGSIOUX01	BROOKSWS	49	864.02	9.91%	1.77E+02
03/18/2009	6	460702	AMBIENT	1.5	857.98	9.95%	5.37E+00
05/02/2013	6	BIGSIOUX01	BROOKSWS	86	821.73	10.33%	2.95E+02
03/21/2018	6	460702	Ambient	69	809.64	10.46%	2.33E+02
05/12/2022	6	460702	Ambient	123	803.60	10.60%	4.12E+02
07/05/2018	6	CENTBSRR03	EDWQSPZ1	112	779.43	10.90%	3.64E+02
09/04/2019	6	460702	Ambient	72	779.43	10.91%	2.34E+02
05/18/2010	6	460702	AMBIENT	13	773.39	10.94%	4.19E+01
12/18/2019	6	460702	Ambient	18	773.39	11.01%	5.81E+01
05/24/2018	6	CENTBSRR03	EDWQSPZ1	32	761.31	11.24%	1.02E+02

09/26/2018	6	CENTBSRR03	EDWQSPZ1	46	749.22	11.53%	1.44E+02
04/16/2007	6	460702	AMBIENT	29	737.14	11.65%	8.92E+01
09/26/2017	6	CENTBSRR03	EDWQSPZ1	92	731.10	11.87%	2.81E+02
09/14/2010	6	460702	Ambient	54	719.01	12.08%	1.62E+02
06/02/2020	6	460702	Ambient	32	700.89	12.43%	9.36E+01
06/08/2022	6	460702	Ambient	73	694.84	12.54%	2.12E+02
06/18/2008	6	460702	AMBIENT	43	688.80	12.57%	1.24E+02
05/23/2022	6	CENTBSRR03	EDWQSPZ1	72	664.63	13.11%	2.00E+02
08/03/2011	6	460702	Ambient	127	658.59	13.19%	3.49E+02
08/29/2017	6	CENTBSRR03	EDWQSPZ1	52	652.55	13.26%	1.42E+02
04/12/2006	6	460702	AMBIENT	46	646.51	13.34%	1.24E+02
06/17/2014	6	CENTBSRR03	EDWQSPZ1	116	646.51	13.42%	3.13E+02
08/16/2010	6	460702	Ambient	71	634.42	13.61%	1.88E+02
07/18/2013	6	BIGSIOUX01	BROOKSWS	106	634.42	13.64%	2.81E+02
01/07/2020	6	460702	Ambient	17	634.42	13.69%	4.50E+01
10/17/2018	6	CENTBSRR03	EDWQSPZ1	32	628.38	13.76%	8.39E+01
11/14/2019	6	460702	Ambient	33	628.38	13.77%	8.65E+01
07/24/2001	6	460702	AMBIENT	172	622.34	13.83%	4.47E+02
04/15/2009	6	460702	AMBIENT	51	622.34	13.87%	1.32E+02
05/16/2007	6	460702	AMBIENT	24	601.79	14.37%	6.03E+01
04/15/2021	6	460702	Ambient	122	592.73	14.59%	3.02E+02
06/20/2016	6	460702	Ambient	100	590.31	14.67%	2.46E+02
10/19/2010	6	460702	Ambient	30	578.23	14.98%	7.24E+01
05/15/2002	6	460702	AMBIENT	84	577.63	14.99%	2.02E+02
06/15/2005	6	460702	AMBIENT	46	575.21	15.06%	1.10E+02
05/10/2023	6	460702	Ambient	62	571.58	15.13%	1.48E+02
04/16/2021	6	CENTBSRR03	RTBNRIST	116	546.81	15.61%	2.65E+02
03/25/2021	6	CENTBSRR03	RTBNRIST	134	545.60	15.67%	3.05E+02
05/09/2013	6	BIGSIOUX01	BROOKSWS	75	540.77	15.79%	1.69E+02
05/14/2014	6	460702	Ambient	67	535.33	15.94%	1.50E+02
03/19/2003	6	460702	AMBIENT	188	527.48	16.20%	4.14E+02
11/15/2010	6	460702	Ambient	18	514.79	16.54%	3.87E+01
03/09/2016	6	460702	Ambient	94	511.16	16.63%	2.00E+02
06/17/2013	6	460702	Ambient	108	496.66	17.08%	2.24E+02
04/09/2014	6	460702	Ambient	144	494.25	17.17%	2.97E+02
10/24/2017	6	460702	Ambient	38	491.83	17.33%	7.80E+01
02/11/2020	6	460702	Ambient	15	491.83	17.38%	3.08E+01
05/21/2008	6	460702	AMBIENT	37	490.02	17.50%	7.56E+01
06/13/2022	6	CENTBSRR03	EDWQSPZ1	129	489.41	17.56%	2.63E+02
05/08/2013	6	BIGSIOUX01	BROOKSWS	104	478.54	18.03%	2.08E+02
07/10/2013	6	460702	Ambient	116	477.33	18.06%	2.31E+02
10/25/2017	6	CENTBSRR03	EDWQSPZ1	23	474.91	18.12%	4.56E+01
05/30/2012	6	BIGSIOUX01	BROOKSWS	80	473.10	18.19%	1.58E+02
05/30/2013	6	BIGSIOUX01	BROOKSWS	72	471.29	18.28%	1.42E+02
05/22/2023	6	CENTBSRR03	EDWQSPZ1	78	453.76	18.84%	1.48E+02
07/11/2013	6	BIGSIOUX01	BROOKSWS	107	452.55	18.89%	2.02E+02
05/31/2012	6	BIGSIOUX01	BROOKSWS	72	451.95	18.91%	1.36E+02
06/22/2016	6	CENTBSRR03	EDWQSPZ1	100	451.35	18.92%	1.88E+02
04/19/2021	6	CENTBSRR03	RTBNRIST	152	449.53	18.99%	2.85E+02
08/26/2015	6	CENTBSRR03	EDWQSPZ1	69	436.24	19.48%	1.26E+02

08/15/2016	6	460702	Ambient	154	433.22	19.57%	2.78E+02
06/06/2007	6	460702	AMBIENT	35	432.01	19.61%	6.31E+01
10/23/2018	6	460702	Ambient	37	431.41	19.64%	6.66E+01
05/06/2009	6	460702	AMBIENT	18	398.78	21.06%	2.99E+01
05/10/2006	6	460702	AMBIENT	26	396.36	21.20%	4.30E+01
06/19/2018	6	CENTBSRR03	EDWQSPZ1	184	396.36	21.22%	3.04E+02
07/02/2014	6	CENTBSRR03	EDWQSPZ1	100	395.76	21.24%	1.65E+02
08/13/2014	6	460702	Ambient	174	383.67	21.82%	2.79E+02
05/15/2013	6	460702	Ambient	70	380.05	21.99%	1.11E+02
07/20/2016	6	CENTBSRR03	EDWQSPZ1	14	375.22	22.24%	2.19E+01
04/11/2017	6	460702	Ambient	34	372.80	22.32%	5.29E+01
06/06/2018	6	460702	Ambient	128	372.19	22.40%	1.99E+02
06/06/2013	6	BIGSIOUX01	BROOKSWS	93	370.38	22.52%	1.44E+02
05/23/2013	6	BIGSIOUX01	BROOKSWS	54	364.94	22.75%	8.22E+01
03/21/2012	6	460702	AMBIENT	108	364.34	22.79%	1.64E+02
03/19/2014	6	460702	Ambient	121	362.53	22.97%	1.83E+02
05/16/2013	6	BIGSIOUX01	BROOKSWS	67	355.88	23.28%	9.95E+01
06/20/2013	6	BIGSIOUX01	BROOKSWS	138	355.88	23.29%	2.05E+02
07/09/2015	6	460702	Ambient	213	355.28	23.32%	3.16E+02
05/21/2014	6	CENTBSRR03	EDWQSPZ1	41	354.67	23.37%	6.07E+01
10/31/2018	6	CENTBSRR03	EDWQSPZ1	33	352.26	23.48%	4.85E+01
08/12/2015	6	460702	Ambient	136	347.42	23.78%	1.97E+02
10/12/2016	6	460702	Ambient	61	341.98	24.13%	8.70E+01
07/11/2022	6	CENTBSRR03	EDWQSPZ1	200	340.17	24.23%	2.84E+02
05/26/2012	6	BIGSIOUX01	BROOKSWS	190	335.94	24.48%	2.66E+02
11/08/2017	6	CENTBSRR03	EDWQSPZ1	36	335.34	24.50%	5.04E+01
05/23/2012	6	BIGSIOUX01	BROOKSWS	144	328.69	24.74%	1.97E+02
06/21/2013	6	BIGSIOUX01	BROOKSWS	146	323.25	24.99%	1.97E+02
03/08/2017	6	460702	Ambient	59	323.25	25.02%	7.96E+01
04/26/2017	6	CENTBSRR03	EDWQSPZ1	26	322.04	25.05%	3.49E+01
06/21/2017	6	CENTBSRR03	EDWQSPZ1	39	313.59	25.52%	5.10E+01
08/01/2018	6	CENTBSRR03	EDWQSPZ1	82	311.17	25.65%	1.06E+02
03/28/2006	6	460702	AMBIENT	47	309.96	25.70%	6.08E+01
06/02/2000	6	CENTBSRR03	CENTBSR1	174	309.36	25.77%	2.25E+02
05/24/2012	6	BIGSIOUX01	BROOKSWS	140	305.13	25.95%	1.78E+02
06/12/2017	6	460702	Ambient	152	302.11	26.15%	1.92E+02
05/10/2017	6	460702	AMBIENT	65	300.90	26.23%	8.16E+01
04/22/2002	6	460702	AMBIENT	54	300.29	26.24%	6.77E+01
06/07/2017	6	CENTBSRR03	EDWQSPZ1	98	297.27	26.44%	1.22E+02
11/14/2018	6	460702	Ambient	26	296.06	26.56%	3.21E+01
06/03/2015	6	CENTBSRR03	EDWQSPZ1	156	290.63	26.80%	1.89E+02
04/16/2008	6	460702	AMBIENT	104	288.21	26.95%	1.25E+02
06/08/2016	6	CENTBSRR03	EDWQSPZ1	90	287.60	26.99%	1.08E+02
05/17/2012	6	BIGSIOUX01	BROOKSWS	122	287.00	27.02%	1.46E+02
08/17/2016	6	CENTBSRR03	EDWQSPZ1	126	287.00	27.03%	1.51E+02
05/03/2021	6	CENTBSRR03	RTBNRIST	168	286.40	27.08%	2.01E+02
03/09/2021	6	460702	Ambient	296	280.35	27.37%	3.46E+02
05/11/2017	6	CENTBSRR03	EDWQSPZ1	46	279.15	27.45%	5.36E+01
08/08/2018	6	460702	Ambient	108	279.15	27.47%	1.26E+02
07/16/2014	6	460702	Ambient	94	278.54	27.50%	1.09E+02

05/12/2016	6	CENTBSRR03	EDWQSPZ1	74	277.94	27.60%	8.58E+01
11/18/2009	6	460702	AMBIENT	29	277.33	27.64%	3.36E+01
07/25/2013	6	BIGSIOUX01	BROOKSWS	194	274.92	27.79%	2.23E+02
12/08/2010	6	460702	Ambient	12	271.90	28.03%	1.36E+01
06/06/2012	6	460702	Ambient	154	270.69	28.17%	1.74E+02
08/21/2001	6	460702	AMBIENT	146	268.87	28.24%	1.64E+02
05/18/2005	6	460702	AMBIENT	32	268.87	28.26%	3.59E+01
05/20/2012	6	BIGSIOUX01	BROOKSWS	196	267.06	28.34%	2.18E+02
05/20/2015	6	CENTBSRR03	EDWQSPZ1	127	264.04	28.57%	1.40E+02
04/27/2016	6	CENTBSRR03	EDWQSPZ1	47	261.62	28.76%	5.13E+01
12/11/2017	6	460702	Ambient	31	260.42	28.84%	3.37E+01
04/06/2016	6	460702	Ambient	59	258.60	29.07%	6.37E+01
05/11/2016	6	460702	Ambient	108	258.60	29.09%	1.17E+02
07/18/2018	6	CENTBSRR03	EDWQSPZ1	160	256.79	29.25%	1.71E+02
11/02/2021	6	460702	Ambient	96	255.58	29.36%	1.02E+02
04/13/2005	6	460702	AMBIENT	70	254.37	29.42%	7.43E+01
04/15/2013	6	460702	Ambient	119	250.14	29.73%	1.24E+02
09/14/2011	6	460702	Ambient	128	240.48	30.55%	1.28E+02
04/04/2012	6	460702	Ambient	120	240.48	30.56%	1.20E+02
11/16/2017	6	460702	Ambient	26	238.66	30.75%	2.59E+01
10/18/2016	6	CENTBSRR03	EDWQSPZ1	45	238.06	30.83%	4.47E+01
06/07/2012	6	BIGSIOUX01	BROOKSWS	126	237.46	30.90%	1.25E+02
07/14/2020	6	460702	Ambient	232	235.04	31.15%	2.27E+02
08/02/2017	6	CENTBSRR03	EDWQSPZ1	140	232.02	31.38%	1.36E+02
10/26/2009	6	460702	AMBIENT	54	226.58	31.88%	5.10E+01
04/12/2022	6	460702	Ambient	112	225.37	32.05%	1.05E+02
05/12/2021	6	460702	Ambient	124	222.95	32.28%	1.15E+02
07/14/2000	6	CENTBSRR03	CENTBSR1	326	217.52	32.64%	2.96E+02
07/06/2022	6	460702	Ambient	112	216.91	32.81%	1.01E+02
09/06/2017	6	460702	Ambient	41	215.70	32.89%	3.69E+01
06/16/2004	6	460702	AMBIENT	51	212.08	33.05%	4.51E+01
04/11/2016	6	CENTBSRR03	EDWQSPZ1	38	212.08	33.07%	3.36E+01
08/27/2014	6	CENTBSRR03	EDWQSPZ1	80	207.24	33.62%	6.92E+01
09/21/2005	6	460702	AMBIENT	92	203.62	33.96%	7.82E+01
09/13/2016	6	CENTBSRR03	EDWQSPZ1	81	202.41	34.06%	6.84E+01
12/10/2018	6	460702	Ambient	17	199.39	34.47%	1.41E+01
09/17/2001	6	460702	AMBIENT	128	193.35	35.09%	1.03E+02
07/29/2015	6	CENTBSRR03	EDWQSPZ1	89	190.93	35.51%	7.09E+01
09/10/2018	6	460702	Ambient	84	189.72	35.61%	6.65E+01
07/22/2009	6	460702	AMBIENT	160	189.12	35.69%	1.26E+02
07/01/2015	6	CENTBSRR03	EDWQSPZ1	150	187.31	35.88%	1.17E+02
08/01/2013	6	BIGSIOUX01	BROOKSWS	130	186.70	35.96%	1.01E+02
05/24/2000	6	460702	AMBIENT	188	184.89	36.18%	1.45E+02
08/28/2018	6	CENTBSRR03	EDWQSPZ1	84	184.89	36.24%	6.48E+01
03/26/2008	6	460702	AMBIENT	50	181.26	36.56%	3.78E+01
03/16/2011	6	460702	Ambient	36	181.26	36.71%	2.72E+01
08/12/2020	6	460702	Ambient	146	177.03	37.34%	1.08E+02
10/19/2011	6	460702	Ambient	29	172.20	37.81%	2.08E+01
08/07/2013	6	460702	Ambient	113	171.60	37.88%	8.09E+01
08/08/2013	6	BIGSIOUX01	BROOKSWS	9	166.76	38.62%	6.26E+00

05/25/2016	6	CENTBSRR03	EDWQSPZ1	85	165.55	38.77%	5.87E+01
01/20/2011	6	460702	Ambient	11	163.14	39.08%	7.49E+00
05/25/2021	6	CENTBSRR03	RTBNRIST	208	161.32	39.37%	1.40E+02
12/12/2016	6	460702	Ambient	20	160.12	39.54%	1.34E+01
09/15/2016	6	460702	Ambient	116	158.91	39.63%	7.69E+01
02/09/2011	6	460702	Ambient	4	157.10	39.94%	2.62E+00
06/21/2012	6	BIGSIOUX01	BROOKSWS	184	157.10	39.98%	1.21E+02
09/12/2018	6	CENTBSRR03	EDWQSPZ1	78	155.89	40.21%	5.07E+01
11/09/2011	6	460702	Ambient	27	154.07	40.47%	1.74E+01
11/02/2016	6	CENTBSRR03	EDWQSPZ1	25	154.07	40.49%	1.61E+01
06/03/2021	6	460702	Ambient	248	154.07	40.51%	1.59E+02
06/28/2000	6	CENTBSRR03	CENTBSR1	262	153.47	40.52%	1.68E+02
06/13/2012	6	BIGSIOUX01	BROOKSWS	158	152.87	40.57%	1.01E+02
06/14/2012	6	BIGSIOUX01	BROOKSWS	160	152.87	40.58%	1.02E+02
10/16/2007	6	460702	AMBIENT	126	151.66	40.76%	7.97E+01
04/21/2003	6	460702	AMBIENT	69	150.45	41.11%	4.33E+01
05/14/2003	6	460702	AMBIENT	84	149.84	41.19%	5.25E+01
06/24/2009	6	460702	AMBIENT	160	149.24	41.24%	9.96E+01
09/10/2014	6	460702	Ambient	136	149.24	41.26%	8.47E+01
08/15/2013	6	BIGSIOUX01	BROOKSWS	61	147.43	41.47%	3.75E+01
08/15/2018	6	CENTBSRR03	EDWQSPZ1	92	145.01	41.81%	5.57E+01
09/28/2016	6	CENTBSRR03	EDWQSPZ1	33	138.97	42.57%	1.91E+01
10/13/2021	6	460702	Ambient	220	137.76	42.77%	1.26E+02
09/12/2017	6	CENTBSRR03	EDWQSPZ1	18	131.11	43.86%	9.85E+00
07/14/2004	6	460702	AMBIENT	126	130.51	43.93%	6.86E+01
11/09/2016	6	460702	Ambient	19	130.51	43.96%	1.03E+01
11/17/2020	6	460702	Ambient	57	129.91	44.10%	3.09E+01
09/27/2006	6	460702	AMBIENT	77	129.30	44.14%	4.15E+01
07/05/2017	6	CENTBSRR03	EDWQSPZ1	61	129.30	44.20%	3.29E+01
01/10/2019	6	460702	Ambient	5	129.30	44.21%	2.70E+00
08/13/2008	6	460702	AMBIENT	224	128.09	44.43%	1.20E+02
06/17/2015	6	CENTBSRR03	EDWQSPZ1	102	125.68	44.96%	5.35E+01
08/14/2017	6	460702	Ambient	136	123.26	45.47%	6.99E+01
08/16/2017	6	CENTBSRR03	EDWQSPZ1	84	122.65	45.58%	4.30E+01
10/06/2004	6	460702	AMBIENT	58	122.05	45.68%	2.95E+01
07/17/2017	6	460702	Ambient	200	121.45	45.87%	1.01E+02
06/07/2021	6	CENTBSRR03	RTBNRIST	240	121.45	45.90%	1.22E+02
05/25/2004	6	460702	AMBIENT	60	120.24	46.20%	3.01E+01
02/14/2017	6	460702	AMBIENT	35	119.63	46.37%	1.75E+01
06/27/2000	6	460702	AMBIENT	276	118.43	46.48%	1.36E+02
07/30/2014	6	CENTBSRR03	EDWQSPZ1	138	118.43	46.56%	6.82E+01
07/15/2015	6	CENTBSRR03	EDWQSPZ1	122	117.82	46.68%	6.00E+01
11/16/2016	6	CENTBSRR03	EDWQSPZ1	5	117.22	46.80%	2.45E+00
06/28/2012	6	BIGSIOUX01	BROOKSWS	166	116.61	46.85%	8.08E+01
08/22/2013	6	BIGSIOUX01	BROOKSWS	56	115.40	47.12%	2.70E+01
06/26/2023	6	CENTBSRR03	EDWQSPZ1	76	115.40	47.19%	3.66E+01
12/09/2015	6	460702	Ambient	11	114.80	47.36%	5.27E+00
06/13/2023	6	460702	Ambient	67	112.99	47.64%	3.16E+01
06/25/2002	6	460702	AMBIENT	202	111.17	47.97%	9.37E+01
10/18/2021	6	CENTBSRR03	RTBNRIST	110	111.17	48.09%	5.10E+01

09/08/2015	6	CENTBSRR03	EDWQSPZ1	88	109.36	48.44%	4.02E+01
11/28/2001	6	460702	AMBIENT	20	108.76	48.52%	9.07E+00
12/17/2001	6	460702	AMBIENT	16	108.76	48.54%	7.26E+00
02/27/2002	6	460702	AMBIENT	16	108.76	48.59%	7.26E+00
11/06/2007	6	460702	AMBIENT	22	106.95	49.13%	9.82E+00
10/29/2001	6	460702	AMBIENT	10	106.34	49.24%	4.44E+00
11/19/2008	6	460702	AMBIENT	16	105.74	49.51%	7.06E+00
05/06/2015	6	CENTBSRR03	EDWQSPZ1	59	105.74	49.58%	2.60E+01
03/28/2000	6	460702	AMBIENT	55	103.32	50.10%	2.37E+01
02/13/2019	6	460702	Ambient	1.5	103.32	50.21%	6.47E-01
07/19/2017	6	CENTBSRR03	EDWQSPZ1	118	100.90	50.92%	4.97E+01
01/09/2018	6	460702	Ambient	6	100.90	50.93%	2.53E+00
11/30/2005	6	460702	AMBIENT	9	99.69	51.16%	3.74E+00
07/15/2008	6	460702	AMBIENT	102	99.09	51.35%	4.22E+01
11/16/2004	6	460702	AMBIENT	12	97.88	51.66%	4.90E+00
08/30/2016	6	CENTBSRR03	EDWQSPZ1	42	97.88	51.75%	1.72E+01
09/03/2020	6	460702	Ambient	112	96.67	52.33%	4.52E+01
08/29/2013	6	BIGSIOUX01	BROOKSWS	118	93.65	53.24%	4.61E+01
09/22/2014	6	CENTBSRR03	EDWQSPZ1	30	93.65	53.25%	1.17E+01
12/09/2020	6	460702	Ambient	32	92.44	53.74%	1.23E+01
12/22/2021	6	460702	Ambient	11	91.84	53.95%	4.21E+00
01/07/2016	6	460702	Ambient	7	90.63	54.44%	2.65E+00
06/14/2006	6	460702	AMBIENT	116	90.03	54.54%	4.36E+01
04/15/2015	6	460702	Ambient	110	90.03	54.61%	4.13E+01
11/18/2013	6	460702	Ambient	11	88.21	55.24%	4.05E+00
01/11/2006	6	460702	AMBIENT	9	87.61	55.42%	3.29E+00
12/21/2009	6	460702	AMBIENT	13	87.61	55.57%	4.75E+00
02/15/2006	6	460702	AMBIENT	15	85.19	56.31%	5.33E+00
08/08/2022	6	460702	Ambient	48	84.59	56.92%	1.69E+01
04/27/2000	6	460702	AMBIENT	104	83.99	56.94%	3.64E+01
07/07/2016	6	CENTBSRR03	EDWQSPZ1	39	83.99	57.08%	1.37E+01
08/03/2016	6	CENTBSRR03	EDWQSPZ1	42	82.78	57.38%	1.45E+01
01/19/2017	6	460702	AMBIENT	10	82.78	57.40%	3.45E+00
09/14/2015	6	460702	Ambient	90	79.15	58.53%	2.97E+01
10/07/2020	6	460702	Ambient	24	78.55	59.02%	7.86E+00
03/29/2005	6	460702	AMBIENT	21	77.34	59.23%	6.78E+00
09/05/2013	6	BIGSIOUX01	BROOKSWS	81	76.73	59.50%	2.59E+01
07/06/2016	6	460702	Ambient	33	75.53	60.18%	1.04E+01
01/09/2012	6	460702	Ambient	15	74.92	60.31%	4.69E+00
02/26/2018	6	460702	Ambient	6	74.32	60.50%	1.86E+00
10/08/2014	6	460702	Ambient	27	73.71	60.70%	8.30E+00
12/21/2005	6	460702	AMBIENT	6	72.51	61.09%	1.81E+00
07/05/2012	6	BIGSIOUX01	BROOKSWS	126	72.51	61.44%	3.81E+01
08/17/2009	6	460702	AMBIENT	118	71.90	61.67%	3.54E+01
12/14/2011	6	460702	Ambient	12	71.90	61.69%	3.60E+00
09/19/2013	6	BIGSIOUX01	BROOKSWS	220	71.90	61.76%	6.60E+01
11/04/2015	6	460702	Ambient	24	71.30	61.95%	7.14E+00
08/09/2023	6	CENTBSRR03	EDWQSPZ1	164	71.30	61.99%	4.88E+01
07/20/2005	6	460702	AMBIENT	236	69.48	62.46%	6.84E+01
07/11/2007	6	460702	AMBIENT	200	69.48	62.48%	5.80E+01

01/14/2010	6	460702	AMBIENT	6	69.48	62.56%	1.74E+00
11/17/2015	6	CENTBSRR03	EDWQSPZ1	21	69.48	62.77%	6.09E+00
02/15/2012	6	460702	Ambient	9	68.88	63.02%	2.59E+00
01/11/2021	6	460702	Ambient	11	68.88	63.26%	3.16E+00
01/29/2021	6	CENTBSRR03	RTBNRIST	3	68.88	63.39%	8.62E-01
10/16/2008	6	460702	AMBIENT	29	67.07	64.05%	8.11E+00
12/22/2020	6	CENTBSRR03	RTBNRIST	11	67.07	64.19%	3.08E+00
09/11/2013	6	460702	Ambient	98	66.46	64.54%	2.72E+01
03/31/2004	6	460702	AMBIENT	29	65.86	64.74%	7.97E+00
09/12/2013	6	BIGSIOUX01	BROOKSWS	94	64.65	65.22%	2.54E+01
11/06/2014	6	460702	Ambient	11	64.65	65.26%	2.97E+00
07/11/2023	6	460702	Ambient	59	64.65	65.32%	1.59E+01
10/16/2006	6	460702	AMBIENT	104	60.06	66.98%	2.61E+01
08/15/2022	6	CENTBSRR03	EDWQSPZ1	53	58.79	67.45%	1.30E+01
06/11/2003	6	460702	AMBIENT	106	57.94	67.80%	2.56E+01
10/09/2013	6	460702	Ambient	41	57.16	68.38%	9.78E+00
07/09/2012	6	460702	Ambient	144	56.49	68.61%	3.39E+01
09/19/2007	6	460702	AMBIENT	67	55.95	68.84%	1.56E+01
07/17/2023	6	CENTBSRR03	EDWQSPZ1	48	55.41	68.99%	1.11E+01
12/15/2004	6	460702	AMBIENT	8	55.16	69.09%	1.84E+00
12/05/2007	6	460702	AMBIENT	7	54.38	69.47%	1.59E+00
03/11/2015	6	460702	Ambient	18	54.38	69.60%	4.08E+00
06/23/2021	6	CENTBSRR03	RTBNRIST	52	54.14	69.76%	1.17E+01
09/26/2013	6	BIGSIOUX01	BROOKSWS	44	54.02	69.83%	9.92E+00
09/23/2015	6	CENTBSRR03	EDWQSPZ1	61	53.96	69.84%	1.37E+01
08/16/2007	6	460702	AMBIENT	156	52.99	70.20%	3.45E+01
10/07/2015	6	CENTBSRR03	EDWQSPZ1	22	52.14	70.39%	4.79E+00
07/27/2000	6	460702	AMBIENT	132	51.96	70.41%	2.86E+01
02/24/2000	6	460702	AMBIENT	13	51.36	70.63%	2.79E+00
01/22/2002	6	460702	AMBIENT	11	51.36	70.71%	2.36E+00
02/18/2010	6	460702	AMBIENT	8	51.36	70.82%	1.71E+00
02/11/2015	6	460702	Ambient	8	50.75	71.02%	1.69E+00
07/12/2012	6	BIGSIOUX01	BROOKSWS	45	49.91	71.24%	9.37E+00
07/12/2021	6	CENTBSRR03	RTBNRIST	102	47.97	72.14%	2.04E+01
09/15/2009	6	460702	AMBIENT	74	46.77	72.54%	1.44E+01
01/22/2015	6	460702	Ambient	9	45.92	72.75%	1.72E+00
10/19/2015	6	460702	Ambient	8	45.68	72.94%	1.52E+00
10/21/2015	6	CENTBSRR03	EDWQSPZ1	15	45.32	73.13%	2.84E+00
09/25/2008	6	460702	AMBIENT	92	44.35	73.48%	1.70E+01
11/02/2000	6	CENTBSRR03	CENTBSR1	131	42.90	73.93%	2.34E+01
10/08/2002	6	460702	AMBIENT	30	42.36	74.11%	5.30E+00
09/09/2021	6	460702	Ambient	108	42.36	74.12%	1.91E+01
12/15/2006	6	460702	AMBIENT	12	42.29	74.27%	2.12E+00
02/17/2016	6	460702	Ambient	1.5	42.29	74.46%	2.65E-01
01/11/2022	6	460702	Ambient	8	41.51	74.77%	1.39E+00
02/23/2021	6	CENTBSRR03	RTBNRIST	5	41.39	74.81%	8.63E-01
08/16/2006	6	460702	AMBIENT	172	41.15	74.90%	2.95E+01
08/10/2000	6	460702	AMBIENT	96	41.09	74.93%	1.65E+01
12/17/2008	6	460702	AMBIENT	6	41.09	74.96%	1.03E+00
09/20/2021	6	CENTBSRR03	RTBNRIST	40	40.97	75.05%	6.84E+00

08/16/2021	6	CENTBSRR03	RTBNRIST	212	40.72	75.09%	3.60E+01
07/09/2002	6	460702	AMBIENT	108	39.58	75.52%	1.78E+01
09/01/2022	6	460702	Ambient	67	39.09	75.93%	1.09E+01
11/13/2023	6	460702	AMBIENT	6	39.09	75.95%	9.79E-01
09/14/2021	6	CENTBSRR03	RTBNRIST	38	38.85	76.00%	6.16E+00
04/14/2004	6	460702	AMBIENT	86	38.61	76.21%	1.39E+01
07/19/2012	6	BIGSIOUX01	BROOKSWS	82	37.52	76.53%	1.28E+01
03/13/2002	6	460702	AMBIENT	15	36.25	76.90%	2.27E+00
07/07/2021	6	460702	Ambient	82	36.25	77.45%	1.24E+01
12/10/2014	6	460702	Ambient	5	33.84	78.50%	7.06E-01
01/09/2008	6	460702	AMBIENT	10	33.23	78.84%	1.39E+00
12/16/2013	6	460702	Ambient	6	32.99	79.07%	8.26E-01
07/19/2021	6	CENTBSRR03	RTBNRIST	80	31.84	79.58%	1.06E+01
02/19/2021	6	CENTBSRR03	RTBNRIST	4	31.54	79.66%	5.26E-01
11/13/2002	6	460702	AMBIENT	7	31.18	79.92%	9.11E-01
12/11/2002	6	460702	AMBIENT	5	30.03	80.75%	6.26E-01
09/19/2022	6	CENTBSRR03	EDWQSPZ1	50	29.67	81.00%	6.19E+00
11/08/2022	6	460702	Ambient	13	29.06	81.35%	1.58E+00
08/09/2012	6	BIGSIOUX01	BROOKSWS	154	28.88	81.53%	1.86E+01
07/26/2012	6	BIGSIOUX01	BROOKSWS	132	28.10	81.87%	1.55E+01
08/08/2012	6	460702	Ambient	144	27.85	82.02%	1.67E+01
08/17/2000	6	CENTBSRR03	CENTBSR1	44	27.79	82.04%	5.10E+00
01/10/2007	6	460702	AMBIENT	8	27.79	82.08%	9.28E-01
10/11/2023	6	460702	Ambient	9	27.61	82.19%	1.04E+00
08/12/2002	6	460702	AMBIENT	86	27.01	82.55%	9.69E+00
08/31/2005	6	460702	AMBIENT	56	26.77	82.65%	6.25E+00
03/03/2022	6	460702	Ambient	10	26.46	82.84%	1.10E+00
01/20/2009	6	460702	AMBIENT	11	25.98	83.06%	1.19E+00
02/08/2022	6	460702	Ambient	13	25.86	83.15%	1.40E+00
09/07/2023	6	460702	Ambient	52	24.83	83.74%	5.39E+00
08/02/2012	6	BIGSIOUX01	BROOKSWS	116	24.23	84.14%	1.17E+01
07/21/2003	6	460702	AMBIENT	120	23.02	85.18%	1.15E+01
02/12/2009	6	460702	AMBIENT	7	22.96	85.33%	6.71E-01
09/09/2002	6	460702	AMBIENT	136	22.84	85.47%	1.30E+01
09/11/2023	6	CENTBSRR03	EDWQSPZ1	42	22.36	85.85%	3.92E+00
10/03/2022	6	460702	Ambient	33	22.05	85.98%	3.04E+00
08/16/2012	6	BIGSIOUX01	BROOKSWS	132	21.81	86.16%	1.20E+01
01/25/2000	6	460702	AMBIENT	6	19.33	87.60%	4.84E-01
09/08/2004	6	460702	AMBIENT	80	19.21	87.82%	6.41E+00
08/02/2021	6	CENTBSRR03	RTBNRIST	90	18.73	88.02%	7.03E+00
10/27/2000	6	CENTBSRR03	CENTBSR1	45	18.13	88.23%	3.40E+00
12/05/2012	6	460702	Ambient	14	18.13	88.49%	1.06E+00
10/24/2000	6	460702	AMBIENT	122	17.52	88.87%	8.92E+00
11/07/2012	6	460702	Ambient	19	17.46	88.98%	1.38E+00
08/23/2012	6	BIGSIOUX01	BROOKSWS	98	17.04	89.06%	6.97E+00
01/15/2014	6	460702	Ambient	5	16.92	89.34%	3.53E-01
08/30/2012	6	BIGSIOUX01	BROOKSWS	134	16.37	89.58%	9.15E+00
03/28/2001	6	460702	AMBIENT	14	16.31	89.71%	9.53E-01
08/28/2012	6	BIGSIOUX01	BROOKSWS	94	15.77	89.97%	6.18E+00
02/16/2005	6	460702	AMBIENT	9	15.71	90.09%	5.90E-01

11/20/2003	6	460702	AMBIENT	39	15.35	90.42%	2.50E+00
12/07/2022	6	460702	Ambient	5	15.11	90.80%	3.15E-01
01/11/2023	6	460702	Ambient	5	14.26	91.36%	2.97E-01
09/11/2000	6	460702	AMBIENT	54	13.29	91.92%	2.99E+00
09/06/2012	6	BIGSIOUX01	BROOKSWS	148	12.75	92.31%	7.87E+00
02/27/2007	6	460702	AMBIENT	16	12.69	92.44%	8.47E-01
02/21/2008	6	460702	AMBIENT	9	12.69	92.46%	4.76E-01
10/16/2012	6	460702	Ambient	57	12.51	92.54%	2.97E+00
11/28/2000	6	460702	AMBIENT	8	12.08	92.67%	4.03E-01
01/10/2005	6	460702	AMBIENT	3	12.08	92.71%	1.51E-01
08/20/2003	6	460702	AMBIENT	100	11.90	92.96%	4.97E+00
10/28/2003	6	460702	AMBIENT	27	11.06	93.61%	1.25E+00
09/20/2012	6	BIGSIOUX01	BROOKSWS	84	10.63	94.12%	3.73E+00
09/27/2012	6	BIGSIOUX01	BROOKSWS	112	10.51	94.19%	4.91E+00
09/13/2012	6	BIGSIOUX01	BROOKSWS	98	10.39	94.28%	4.25E+00
09/12/2012	6	460702	Ambient	130	10.15	94.59%	5.51E+00
03/21/2023	6	460702	Ambient	6	10.03	94.67%	2.51E-01
12/03/2003	6	460702	AMBIENT	24	9.91	94.74%	9.92E-01
10/04/2012	6	BIGSIOUX01	BROOKSWS	70	9.67	95.07%	2.82E+00
01/09/2013	6	460702	Ambient	5	9.67	95.15%	2.02E-01
02/19/2004	6	460702	AMBIENT	11	9.43	95.30%	4.33E-01
12/05/2000	6	460702	AMBIENT	6	9.06	95.50%	2.27E-01
01/21/2004	6	460702	AMBIENT	9	8.28	96.33%	3.11E-01
02/06/2013	6	460702	Ambient	7	6.04	97.50%	1.76E-01
02/12/2014	6	460702	Ambient	4	6.04	97.58%	1.01E-01
09/03/2003	6	460702	AMBIENT	76	5.89	97.65%	1.87E+00
02/28/2001	6	460702	AMBIENT	8	5.44	97.88%	1.81E-01
01/28/2003	6	460702	AMBIENT	7	5.44	97.99%	1.59E-01
02/18/2003	6	460702	AMBIENT	6	4.83	98.52%	1.21E-01
03/26/2013	6	460702	Ambient	56	4.83	98.68%	1.13E+00
01/10/2001	6	460702	AMBIENT	4	3.63	99.32%	6.05E-02

Appendix B – Construction Stormwater Permits

Permit Number	Project Address	Permit Expiration Date	Acres Disturbed	Discharge Nature	Latitude	Longitude
SDR10P55E	401 S MAIN AVE, BROOKINGS, SD 57006	03/31/2023	5.7	Construction Stormwater	44.2626	-96.7978
SDR10J184	1801 12TH STREET SOUTH, BROOKINGS, SD 57006	03/31/2023	5.8	Construction of Buildings	44.293303	-96.776377
SDR10I078	23RD ST. S, BROOKINGS, SD 57006	10/31/2028	10.8	Highway, Bridge, and Street Construction	44.2783	-96.7748
SDR10P50R	20TH ST S & TANBURY LANE, BROOKINGS, SD 57006	10/31/2028	25	Branch Creek Addition	44.2819	-96.7817
SDR10K545	20TH STREET S & ACE AVENUE, BROOKINGS, SD 57006	03/31/2023	3.3	Construction of Buildings	44.280116	-96.770968
SDR10P510	SE CORNER OF 20TH STREET SOUTH AND ACE AVENUE, BROOKINGS, SD 57006	10/31/2028	3.1	Construction Stormwater	44.2817	-96.7711
SDR10P249	1500 BLOCK OF MAIN AVE S, BROOKINGS, SD 57006	10/31/2028	5.8	Water and Swer Line and Related Structures Construction	44.2878	-96.7982
SDR10H798	CHRISTINE AVE, BROOKINGS, SD 57006	03/31/2023	14	Commercial Building Construction	44.288056	-96.781943
SDR10P50V	44TH ST S AND MAIN AVE S, BROOKINGS, SD 57006	10/31/2028	15	Sanitary Sewer Replacement Phase II	44.2537	-96.8022
SDR10P52L	4316 WESTERN AVE S, BROOKINGS, SD 57006	10/31/2028	20	Sanitary Sewer Replacement Phase III	44.255	-96.8083
SDR10F360	423 8TH ST S., BROOKINGS, SD 57006	03/31/2023	34.5	Residental Construction	44.284444	-96.779722
SDR10P59J	9TH STREET MADISON, MADISON, SD 57042	10/31/2028	36.6	Construction Stormwater	44.1093	-97.1296
SDR10P51X	232ND STREET & E OF WASHINGTON AVE., MADISON, SD 57042	10/31/2028	29.2	Construction Stormwater	44.0214	-97.1047

Appendix C – Simple Method Calculation Procedure

The Simple Method (Schueler, 1987) was used to estimate the Total Suspended Solids Loadings from the City of Brookings, SD. The Simple Method in this TMDL estimates pollutant loads for chemical constituents as a product of annual runoff volume and pollutant concentration for SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06. The pollutant load was calculated and then divided by 365 to get an estimated daily load. The daily load for 2012 and 2013 for both SD-BS-R-BIG_SIOUX_05 and SD-BS-R-BIG_SIOUX_06 was averaged and converted to ton/day to estimate the daily load of the MS4.

Equation 1 – Annual Load

$$L = 0.226 * R * C * A$$

Where: L = Annual load (lbs)
R = Annual runoff (inches)
C = Pollutant concentration (mg/L)
A = Area (acres)
0.226 = Unit conversion factor

Annual Load - SD-BS-R-BIG_SIOUX_05	2012	2013	Avg. Year
L (annual load/lbs) =x*R*C*A	3.38E+05	9.31E+05	6.34E+05
x (unit conversion)	0.226	0.226	
R=Annual runoff (inches)	4.450	4.538	
C=Pollutant concentration (mg/L)	73.5	198.6	
A=Area (acres)	4569	4569	
Standard	90	90	
L allowed (if Loading Capacity is met)(annual)	4.14E+05	4.22E+05	4.18E+05
L allowed (if Loading Capacity is met)(daily/365	1.13E+03	1.16E+03	1.14E+03
L allowed (tons/day)			5.72E-01

Annual Load - SD-BS-R-BIG_SIOUX_06	2012	2013	Avg. Year
L (annual load in lbs) = x*R*C*A	2.15E+05	4.63E+05	3.39E+05
x (unit conversion)	0.226	0.226	
R=Annual runoff (inches)	4.034	4.114	
C=Pollutant concentration (mg/L)	57.7	121.8	
A=Area (acres)	4092	4092	
Standard	90	90	
L allowed (if Loading Capacity is met)(annual)	3.36E+05	3.42E+05	3.39E+05
L allowed (if Loading Capacity is met)(daily/365)	9.20E+02	9.38E+02	9.29E+02
L allowed (tons/day)			4.65E-01

The annual runoff (**R**) was calculated using the equation:

$$R = P * Pj * Rv$$

Where: R = Annual runoff (inches)

P = Annual rainfall (inches)
Pj = Fraction of annual rainfall events that produce runoff (estimated at 0.9)
Rv = Runoff coefficient

The calculation for Runoff Coefficient is based on impervious cover in the subwatershed. The percent imperviousness (**Ia**) was calculated using current NLCD estimates.

The annual runoff coefficient (**Rv**) was calculated using the equation:

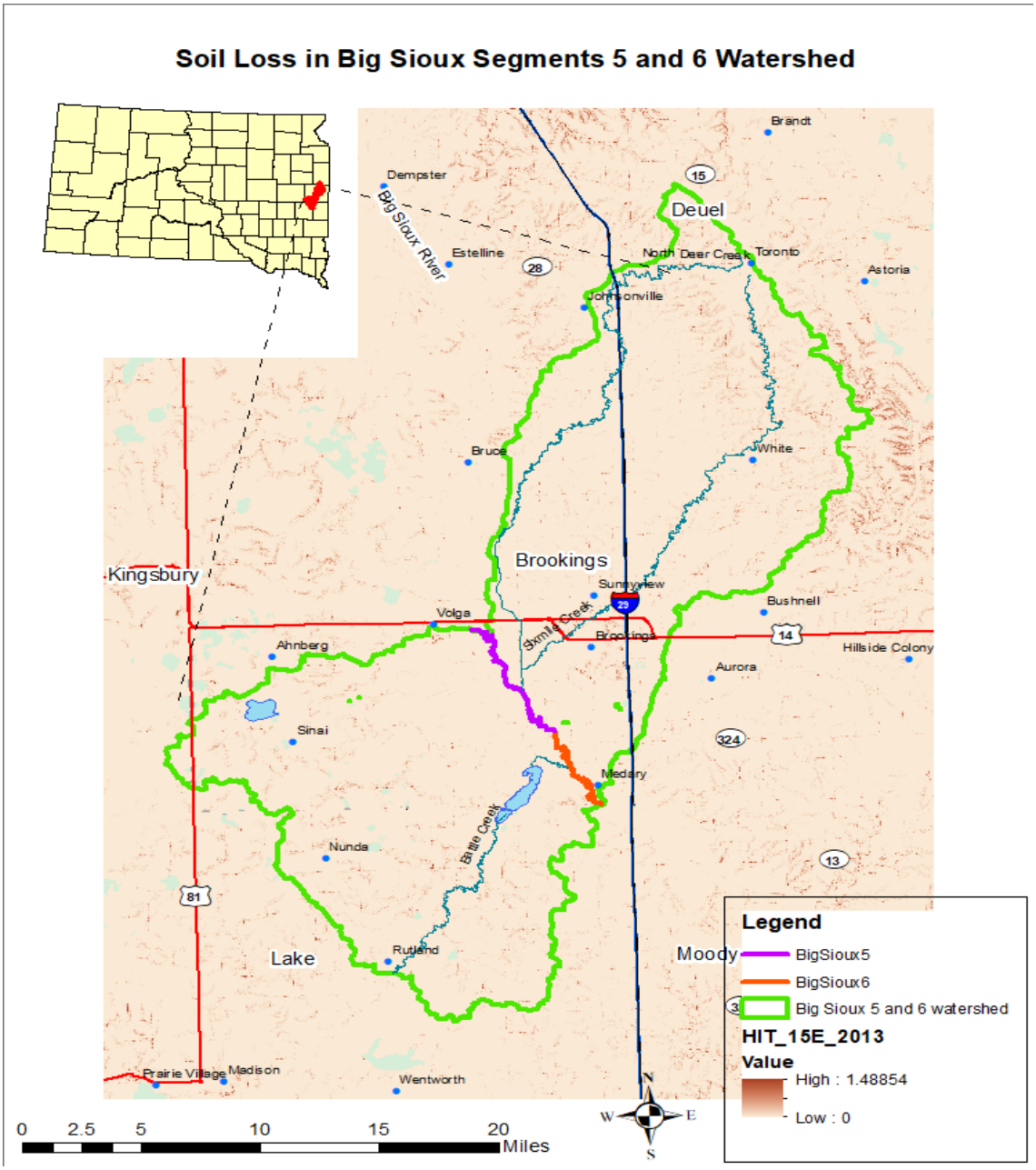
$$Rv = 0.05 + 0.9Ia$$

Annual Runoff (R) - SD-BS-R-BIG_SIOUX_05		2012	2013
R=P*Pj*Rv		4.450	4.538
where R= Annual runoff (inches)			
P=Annual rainfall (inches)		22.82	23.27
Pj= Fraction of annual rainfall events that produce runoff (.9)			
Rv= Runoff coefficient		0.21668	0.21668
Annual runoff coefficient Rv			
Rv=.05+.9Ia	0.9		
Rv=	0.21668		
Ia = percent impervious	0.1852		

Annual Runoff (R) - SD-BS-R-BIG_SIOUX_06		2012	2013
R=P*Pj*Rv		4.034	4.114
where R= Annual runoff (inches)			
P=Annual rainfall (inches)		22.82	23.27
Pj= Fraction of annual rainfall events that produce runoff (.9)			
Rv= Runoff coefficient		0.19643	0.19643
Annual runoff coefficient Rv			
Rv=.05+.9Ia	0.9		
Rv=	0.19643		
Ia = percent impervious	0.1627		

Appendix D – High Impact Targeting (HIT) Model

High Impact Targeting (HIT) is a RUSLE-based model which uses climatic and land use data for a given year that incorporates soil delivery ratios based on SEDMOD. RUSLE is a model that expresses soil loss based on rainfall energy, soil properties, topographic factors, land use, and soil conservation practices. SEDMOD is a model that expresses delivery ratios to streams based on the distance from cells to streams. The HIT combines these models and demonstrates the relative export of soil via overland erosion processes to the stream. The figure below shows a typical year of sediment transport in 2013 expressed in tons/acre/year delivered to the stream. As evident from figure below, soil loss in the watershed is relatively low except for certain isolated areas in the upper Six Mile Creek and upper North Deer Creek watersheds.



Appendix E – Public Comments and SDDANR Response

EAST DAKOTA WATER DEVELOPMENT DISTRICT

September 3, 2024

Alan Wittmuss
SD DANR - Watershed Protection Program
USD Akeley-Lawrence Science Center
414 East Clark
Vermillion, South Dakota 57069

Dear Mr. Wittmuss:

I am writing to offer comments on behalf of the East Dakota Water Development District on the DRAFT Total Suspended Solids (TSS) Total Maximum Daily Load and Water Quality Improvement Plan for the Big Sioux River (BSR) Segments 5 and 6, Brookings County, South Dakota. For each I have included a page reference from the DRAFT document.

1. Page 2, Section 2.0 Watershed Characteristics, and associated Figure 1. The second paragraph of this section describes the areal extent (watershed and drainage area) of SD-BS-R-BIG_SIOUX_06. Figure 1 is a graphic representation of the area. The associated hydrologic unit codes (HUCs) for the area are presented on a prior page (**Big Sioux Segment 6 Total Maximum Daily Load Summary**). The list of associated HUCs is incomplete, and the extent of the watershed of this segment is therefore incorrect.

   There are two additional 12-digit HUCs that are part of the Battle Creek watershed, which feeds Lake Campbell. They are: Lake Madison Church-Battle Creek (#101702020802) and Lake Badus-Battle Creek (#101702020801). The missing territory amounts to 59,400 acres/~240 square miles. Figures 1, 2, 3, 4 and 8 all show the incorrect extent of the Battle Creek watershed. Further, any references in the text to the areal extent of the area, land use allocations, loadings(?), etc.., are therefore incorrect, and will need to be reassessed before the report is finalized.

2. Page 4, Section 2.2, Geology and Soils, and associated Figure 2. The fifth sentence of this paragraph reads, "The watershed is made up of productive mollisols along with silty clay loams and clay loams (***Figure 2***)." The implication of this sentence is that Figure 2 shows the distribution of the aforementioned soils in the area in question, the watershed of BSR segments 5 and 6. However, as the title makes clear, Figure 2 is the "Occurrence of Aquifer Material in Big Sioux Segments 5 and 6 Watershed." If

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the ultimate intent is to show the distribution of soils in the area, a completely different figure is required.

3. Page 4, Figure 2. Working on the assumption that the information presented in this figure was desired by the author, what is the source of the material presented? There is no reference to where it came from. While the image might have been prepared by the report author, the basic information presented comes from other sources. Specifically, this information was drawn from four (4) different maps created by the South Dakota Geological Survey. They are: AM-10, First Occurrence of Aquifer Materials in Moody County, South Dakota; AM-11, First Occurrence of Aquifer Materials in Lake County, South Dakota; AM-19, First Occurrence of Aquifer Materials in Brookings County, South Dakota; and AM-24, First Occurrence of Aquifer Materials in Kingsbury County, South Dakota.

   Within the figure itself, there are several hiccups:

   A. The portion of Kingsbury County included in the watershed is colored pale green. It should be dark gray;
   B. There are two pale green areas shown in Lake and Moody Counties. They are areas where the first "aquifer material" is the Niobrara Formation, a unit not found in the Legend;
   C. The areas along Battle Creek underlain by alluvium and outwash in Lake and Moody Counties area shaded pale green (a seemingly popular color). They should be either yellow or light or light gray according to the Legend; and
   D. The Legend has a unit (Dakota Formation 100+) that is not represented on the map.

   As noted in Comment #1, the true outline of the area in question is improperly portrayed, and therefore this figure will need to be adjusted accordingly.

4. Page 6, Section 2.4, Land use.

   The first paragraph, and associated Table 1, describe land use (and changes) within the area as recorded by the National Land Cover Dataset (NLCD) conducted in 2006 and 2017. It also offers commentary on differences between the two reporting periods.

   In the third sentence, it is noted that, "Wetlands and forested areas have decreased since 2006 while grassland used for grazing has ***significantly*** (emphasis added) increased over the years." My question revolves around the emphasis placed on the change in grasslands coverage. As reported in Table 1, 11.65% of the watershed was comprised of "grassland" in 2006, rising to 17.51% by 2017. This represents a roughly 50% increase, clearly a "significant" change worth noting. However, wetland

loss exceeded 72% over this same period. This too is a significant change, and yet no special mention is made. Given the critical role of wetlands in natural water quality protection, the lack of emphasis on this change is problematic.

As noted in Comment #1, the true outline of the area in question is improperly portrayed, and therefore this section will need to be re-assessed based on a larger total area, with text, etc.., adjusted accordingly.

5. The data presented in Table 1 provides fodder for additional consideration:

   A. What is the "Barren" land use, and what is the meaning/implication of a 97.5% reduction between 2006 and 2017? This may have no direct relation to the overall TMDL report, but in that the text saw fit to draw attention to a relatively lesser change, this should be explained; and
   B. The "Developed" category is shown to have undergone a 29% reduction over the interval. Assuming this category includes would include the residential, commercial and industrial in and around the City of Brookings, which is wholly within the watershed of Segments 5 & 6, this seems problematic. My own "on the ground" observations would suggest there should have been an increase in "Developed" territory.

If you have any questions about my comments/questions, please do not hesitate to contact me.

Sincerely,

Jay P. Gilbertson
Manager/Treasurer

SDDANR Responses

Thank you for the comments SDDANR received as part of the public comment period associated with the Total Suspended Solids (TSS) Total Maximum Daily Load and Water Quality Improvement Plan for Big Sioux River Segments 05 and 06, Brookings County, South Dakota.

Response to Comment 1 referring to Section 2.0 Watershed Characteristics, and associated Figure 1:

The additional 12-digit HUCs (Battle Creek Watershed) have been incorporated into the overall development of this TMDL.

Response to Comment 2 and 3 referring to Section 2.2 Geology and Soils, and associated Figure 2:

Section 2.2 was recreated as "*Soil Type*". Information and data previously concerning aquifer materials in the watershed area was replaced with information focusing on soil type(s). The original figure in question was updated to illustrate soil type in the watershed area.

Response to Comment 4 and 5 referring to Section 2.4 Land Cover:

SDDANR Land Cover GIS shapefiles for the Big Sioux River Segment 05 and 06 were created several years before this report was written to completion. When updating land cover to incorporate the newly added 12-digit HUCs, the shapefiles used for the previous representation of the watershed- not including the newly added 12-digit HUCs- could not be referenced. As a result, new shapefiles were gathered from the Multi-Resolution Land Characteristics Consortium (MRLC) which is sourced from the National Land Cover Database, to create new shapefiles for the area of interest. MRLC shapefile data used in this report included the 2006 NLCD and most recent, 2021 NLCD data. The MRLC shapefiles include a 16-class legend which differs from the shapefiles previously used which offer a 9-class legend. The 16-class legend has increased accuracy of the overall land use percentages of the Big Sioux River Segment 05 and 06. Definitions of class legend categories have been referenced in the section to provide additional clarity to the readers of this report.

Language referring to the *significant* changes portrayed by land use percentages between the NLCD reporting years was eliminated when new shapefile data revealed no significant changes had occurred.

Appendix F – EPA Approval Letter and Decisions Document

REGION 8
DENVER, CO 80202

SENT VIA EMAIL

Hunter Roberts
Secretary
South Dakota Department of Agriculture & Natural Resources
Hunter.Roberts@state.sd.us

Re: Approval of Total Suspended Solids (TSS) Total Maximum Daily Load And Water Quality Improvement Plan For The Big Sioux River Segments 5 And 6 Brookings County, South Dakota

Dear Mr. Roberts:

The U.S. Environmental Protection Agency (EPA) has completed review of the total maximum daily loads (TMDLs) submitted by your office on December 3, 2024. In accordance with the Clean Water Act (33 U.S.C. §1251 *et. seq*.) and the EPA's implementing regulations at 40 C.F.R. Part 130, the EPA hereby approves South Dakota's TMDLs for segments 5 and 6 of the Big Sioux River. The EPA has determined that the separate elements of the TMDLs listed in the enclosure adequately address the pollutant of concern, are designed to attain and maintain applicable water quality standards, consider seasonal variation and includes a margin of safety. The EPA's rationale for this action is contained in the enclosure.

The EPA's approval of South Dakota's submitted TMDLs extends to waterbodies in South Dakota with the exception of those waters that are within Indian country, as defined in 18 U.S.C. Section 1151, or to lands of exclusive federal jurisdiction. The EPA is taking no action to approve or disapprove the state's TMDLs with respect to those waters. The EPA, or eligible Indian Tribes, as appropriate, will retain responsibilities under Clean Water Act Section 303(d) for those waters.

We appreciate the South Dakota Department of Agriculture & Natural Resources efforts to complete these TMDLs. If you have any questions, please contact Justin Wiese at wiese.justin@epa.gov or 303-312-6637.

Sincerely,

Stephanie DeJong, Manager
Clean Water Branch

Enclosure

cc: Alan Wittmuss, TMDL Team Lead, South Dakota Department of Environment & Natural Resources

EPA'S TOTAL MAXIMUM DAILY LOAD (TMDL) DECISION RATIONALE

TMDL: Total Suspended Solids Total Maximum Daily Load Evaluation for the Big Sioux River Segments 5and 6 Brookings County, South Dakota

ATTAINS ID: R8-SD-2025-01

LOCATION: Brookings County, South Dakota

IMPAIRMENTS/POLLUTANTS: The TMDL submittal addresses two river segments with a warmwater semipermanent fish life propagation use that is impaired due to high concentrations of total suspended solids (TSS).

WATERBODY/POLLUTANTS ADDRESSED IN THIS TMDL ACTION

Assessment Unit ID	Waterbody Description	Pollutants Addressed
SD-BS-R-BIG_SIOUX_05	Big Sioux River (near Volga, SD to near Brookings, SD)	TSS
SD-BS-R-BIG_SIOUX_06	Big Sioux River (Brookings, SD to Brookings/Moody County line)	TSS

BACKGROUND: The South Dakota Department of Agriculture and Natural Resources (DANR) submitted to EPA the TSS TMDLs for Big Sioux River segments 5 (SD-BS-R-BIG_SIOUX_05) and 6 (SD-BS-R-BIG_SIOUX_06) with a letter requesting review and approval dated November 5, 2024. DANR subsequently withdrew and resubmitted an updated version of the TMDL report for final EPA review and approval on December 3, 2024. The updated report provided additional information on DANR's public participation process that was inadvertently omitted in the original submission.

The submittal included:

- Letter requesting the EPA's review and approval of the TMDLs
- Final TMDL report for Total Suspended Solids Total Maximum Daily Load Evaluation for the Big Sioux River Segments 5 and 6 Brookings County, South Dakota
- Water quality monitoring data

ACTION: Based on the EPA's review of South Dakota's TMDL submittal and other relevant information in the administrative record for this action, the EPA approves the final Big Sioux Segments 5 and 6 TMDL.

TMDL APPROVAL SUMMARY

Number of TMDLs Approved:	2
Number of Parameters Addressed by TMDLs:	2

The following explains how the TMDL submission meets the statutory and regulatory requirements of TMDLs in accordance with CWA Section 303(d), and the EPA's implementing regulations in 40 C.F.R. Part 130.

This TMDL decision rationale sets forth the EPA's reasoning for approving SD's TSS TMDLs. The EPA has conducted a complete review of the state's TMDLs and supporting documentation and information. This document tracks the EPA's guidelines (EPA, 2002) that summarize the effective statutory and regulatory requirements relating to TMDLs (CWA Section 303(d) and 40 C.F.R. Part 130).

1. Identification of Waterbody, Pollutant of Concern, Pollutant Sources, and Priority Ranking

Big Sioux River segments 5 and 6 are located in eastern South Dakota and are part of the Big Sioux River basin. The Big Sioux River basin drains approximately 8,282 square miles between eastern South Dakota, southwestern Minnesota, and northwestern Iowa. The impaired waterbody segments subject to this TMDL extend approximately 20 miles through Brookings County to the Brookings/Moody County line. Figure 1 of the submittal displays the general location of the segments 5 and 6 watersheds with the impaired segment shown in orange for Big Sioux 5 and purple for Big Sioux 6 as well as monitoring stations and major U.S Geological Survey (USGS) gages.

These segments were first listed as impaired for TSS on South Dakota's 2004 303(d) List and have remained an impairment on subsequent list cycles. Both segments were assigned a Priority 1 (i.e., high priority for TMDL development) on the most recent EPA-approved 303(d) list in South Dakota's 2024 Integrated Report (IR). This priority ranking information is contained in the Appendix D, 303(d) Summary of the 2024 IR. The HUCs associated with each segment are contained within each cycle's 303(d) summaries.

Section 2.4 (Land Cover) and Table 1 of the submittal summarize the land cover distribution draining into the impaired segments, which is predominantly agriculture (67.5%) with developed areas comprising 5% of the watershed per NLCD 2017. The distribution of land cover in the watershed is illustrated in Figure 4 of the submittal.

Section 6.2 (Natural and Nonpoint Sources of Sedimentation) of the submittal discusses nonpoint sources as primarily overland runoff and in-stream bed and bank erosion. Local human activities can accelerate the natural erosional processes in a watershed, exacerbating sediment contributions to waterway. Anthropogenic activities such as civil construction of bridges, roads, culverts, and the installation of drain tile from agricultural activities have increased the erosive force on riverbanks and beds. Land use changes over the years have led to the removal of riparian vegetation, which increases sediment loading within the watershed. The natural TSS load was quantified and estimated using South Dakota's reference site network and various literature reference values from Klimetz et al. (2009) as summarized in Section 6.2.1 (Sediment Load Estimates). The Klimetz et al. (2009) report was supported by, and developed for, EPA Region 8.

Point sources are reviewed and described in Section 6.1 (Point Sources) of the submittal. Nine traditional non-stormwater NPDES permitted facilities, one municipal separate storm sewer system

(MS4), and several general construction stormwater permittees and Concentrated Animal Feeding Operations (CAFOs) are documented and are mentioned may directly contribute sediment to the two impaired Big Sioux River segments. These include four permitted wastewater treatment facilities/plants (WWTFs/WWTPs) (City of Volga WWTF (SD0021920), City of White WWTF (SD0021636), Town of Sinai WWTF (SDG820974), and City of Brookings Municipal Utilities WWTP (SD0023388)), one permitted water treatment plant (City of Volga WTP (SDG8600029)), two manufacturing facilities (SD Soybean Processors (SDP000090) and Prairie Aquatech (SDP000133)), one sump discharge (Dacotah Bank (SD0028568)), one recreational facility (SDSU Swimming Pool (SD0026832)), and one MS4 (City of Brookings MS4 (SDR41A003)).

The City of Volga WWTF (SD0021920) discharges continuously into a tributary 1/8 mile upstream of segment 5. The City of Brookings Municipal Utilities WWTP (SD0023388) discharges regularly, but not continuously, directly into segment 6. DANR reviewed the facility characteristics and the quantity of discharge from these facilities using permit information and monitoring data. Individual WLAs are assigned to both facilities.

The discharge characteristics of the remaining seven traditional non-stormwater permittees led DANR to determine they are not sources of TSS.

The City of White WWTF discharges to an unnamed tributary about 1.5 miles upstream from the confluence of Six Mile Creek, which then flows more than 20 miles before reaching segment 5. Due to the distance from the discharge to the Big Sioux River, a zero WLA has been assigned.

The Town of Sinai WWTF is a minor facility with no discharge permitted, excluding emergency conditions, and has had two emergency discharges within the current permit cycle starting December 1, 2018. Considering the over 10-mile distance from the Big Sioux River and the infrequent discharges, a zero WLA has been assigned.

The City of Volga WTP drains to an unnamed tributary four miles upstream from the Big Sioux River. Additionally, due to distance away and the low TSS concentrations that would be present in the full treated drinking water discharged from outfall DW2, a zero WLA has been assigned.

SD Soybean Processors and Prairie Aquatech continuously discharge to the City of Volga WWTF and so their discharges are captured within the WWTF's WLA. Therefore, zero WLAs have been assigned to them.

Dacotah Bank operates a sump discharge, and DANR's rationale is that any discharge will enter the Brookings municipal MS4 stormwater system. Therefore, a zero WLA was assigned. The EPA reviewed permit information and discharge monitoring report (DMR) data for Dacotah Bank based on its permit, which is separate from and not controlled by the MS4 permit. Dacotah Bank currently has a TSS limit of 90 mg/L, and DMR data indicate TSS has been below detection (<5 mg/L) for every sample collected since 2019. Therefore, the EPA agrees a WLA of zero is appropriate.

DANR's rationale states that the SDSU Swimming Pool does not allow discharge of the pollutant of concern, TSS, so a zero WLA was assigned. The EPA reviewed readily available facility information, and the SDSU Swimming Pool was terminated in 2022. Prior to termination, the permit did not have a TSS limit prohibiting discharge. Therefore, the EPA agrees a WLA of zero is appropriate.

The City of Brookings has a population in excess of 10,000 and, therefore, is subject to Phase II requirements of the MS4 regulations. Phase II MS4s are covered by a general permit. Stormwater runoff from the City of Brookings is transported through the MS4 and discharged into either Six Mile Creek (tributary of segment 5) or continues south to enter the mainstem of segment 6. The Simple Method was used to quantify the current MS4 loadings using local precipitation information and runoff coefficients (Scheuler, 1987). The calculation procedures are documented in Appendix C.

Currently there are several non-major construction permittees covered by DANR's construction stormwater general permit that have ongoing operations in the watershed. The status of these construction projects is currently unknown, however they are considered to be active by DANR until the permitted party opts to close the permit. All the permits authorize discharge of stormwater, but do not authorize discharge if the discharge will cause or have the reasonable potential to cause or contribute to violations of surface water quality. Stormwater construction activities must have coverage and comply with South Dakota's General Permit Authorizing Stormwater Discharges Associated with Construction Activities ensuring that discharges are minimal. The TMDL assumes their TSS contribution will be minimal, and unless found otherwise, no additional permit conditions are required by this TMDL. Future permits will remain under the same assumption, unless otherwise established. Construction stormwater permittees can be found in Appendix B.

There are eight permitted CAFOs within the Big Sioux River segments 5 and 6 watershed. Each of the CAFO's facility name, type of operation, and permit number can be found in Table 7 of the submittal. All CAFOs are required to maintain compliance with provisions of the SD Water Pollution Control Act (SDCL 34A-2). SDCL 34A-2-36.2 requires each CAFO, as defined by Title 40 Codified Federal Regulations Part 122.23 dated January 1st, 2007, to operate under a general or individual water pollution control permit issued pursuant to 34A-2-36. The general control permit ensures that all CAFOs in SD have permit coverage regardless of if they meet conditions for coverage under a NPDES permit. DANR notes that as long as these facilities comply with the general CAFO permit requirements ensuring their discharges are unlikely and indirect loading events, the TMDL assumes their TSS contribution is minimal, and unless found otherwise, no additional permit conditions are required by this TMDL.

Assessment: The EPA concludes that DANR adequately identified the impaired waterbody, the pollutant of concern, the priority ranking, the identification, location and magnitude of the pollutant sources, and the important assumptions and information used to develop the TMDLs.

2. Description of the Applicable Water Quality Standards and Numeric Water Quality Target

Section 3.0 (South Dakota Water Quality Standards) describes the water quality standards for the impaired segments with citations to relevant South Dakota regulations. Segments 5 and 6 of the Big Sioux River have been designated the following beneficial uses:

- (5) warmwater semipermanent fish life propagation,
- (8) limited contact recreation,
- (9) fish and wildlife propagation, recreation, and stock watering, and
- (10) irrigation waters.

All numeric criteria applicable to these uses are presented in Table 2 of the submittal (South Dakota Water Quality Criteria for Big Sioux Segments 5 and 6). DANR determined that TSS is preventing the creek's warmwater semipermanent fish life propagation use from being fully supported. Numeric TSS criteria for this use are comprised of a 30-day mean criterion (≤ 90 mg/L) and a single sample maximum criterion (≤ 158 mg/L). These criteria apply year-round.

TMDLs must also consider downstream water quality standards. Big Sioux segment 5 flows into segment 6 which then flows into segment 7 (SD-BS-R-BIG_SIOUX_07). All three segments have the same uses and criteria, except segment 7 which has an additional domestic water supply use assigned. This differing beneficial use does not have TSS criteria associated with the use. Therefore, it is not necessary for segments 5 and 6 to adopt segment 7's additional beneficial use criteria and the TMDL will still be protective of downstream water quality standards.

Considering the applicable local and downstream criteria, DANR selected 90 mg/L TSS as the numeric target for calculating these TMDLs and described the decision as also being protective of the 158 mg/L criterion.

The TMDL is consistent with South Dakota antidegradation policies explained in Section 4 (Antidegradation) of the submittal because it provides recommendations and establishes pollutant limits at water quality levels necessary to meet criteria and fully support existing beneficial uses.

Assessment: The EPA concludes that DANR adequately described its applicable water quality standard and numeric water quality target for these TMDLs.

3. Loading Capacity - Linking Water Quality and Pollutant Sources

Explained in Section 9.0 (Total Suspended Solids TMDL Loading Analysis), the Load Duration Curve (LDC) approach was taken to establish the allowable loading capacity of the pollutant based on the TMDL target of 90 mg/L. EPA published guidance on the use of load duration curves for TMDL development (EPA, 2007) and the practice is well established. In both analyses, segments 5 and 6 were separated into five flow zones (Figure 9 and Figure 10); high flows (0 – 10 percent), moist conditions (10 – 40 percent), mid-range conditions (40 – 60 percent), dry conditions (60 – 90 percent), and low flows (90 – 100 percent) in accordance with EPA guidance (EPA, 2007). Water quality monitoring data

used in the analysis is summarized in Section 7.2 (TSS Water Quality Data) and provided fully in Appendix A (Measured Discharge and TSS Data).

Loading sources were characterized and quantified using multiple approaches in Section 7.0 (Data Collection). All applicable TSS data collected from six stations within the impaired segments during the assessment years 2000 – 2023 (Section 7.2 TSS Water Quality Data) were used for TMDL development. Long term hydrologic records (Section 7.3 Flow Information and Data) were available via the USGS gage station located downstream of segment 6. The USGS gage station identified as 06480000 is located approximately 10 miles south of Brookings, SD and 2 miles south of the Brookings-Moody County line where segment 6 ends. Flow data acquired at this site began in 1953 and is currently active as of 2024. Flow data from the period of assessment (2000 – 2023) was used to develop the load duration curve (LDC) and the TMDL for segments 5 and 6. DANR estimated the flows for each segment from the USGS gage using the drainage area ratio method (Williams-Sether, 1992).

Described in Section 7.4 (Rapid Geomorphic Assessment), Rapid Geomorphic Assessments (RGAs) were conducted on the Big Sioux River in 2007 and assessed in accordance with the Standard Operating Procedures for Field Samplers developed by the Watershed Protection Program of DANR. RGAs help identify unstable portions of the channel. After the first station on segment 5, the channel is in poor condition. The RGA indicates a problem on this stretch of river with a note on hoof action and overgrazing in the area. Then, after North Deer Creek enters the Big Sioux River, channel conditions dramatically improve. By the end of segment 6, the channel is back in the condition it was at the beginning of segment 5 (Figure 8).

DANR further investigated the linkage between pollutant sources and the load delivered to the Big Sioux River using the High Impact Targeting (HIT) model. This effort, described in Section 6.2.1 (Sediment Load Estimates) and Appendix D, produced annual sediment yields by transport mechanism and land use (Table 8). The findings suggest a significant majority of the TSS load originates from row crops and is transported by upland erosion processes. EPA acknowledges this analysis was not re-run after DANR increased the overall watershed size in response to public comments (i.e., 287,104 acres vs. 349,422 acres). As such, EPA assumes the yields presented are underestimated but expects the relative contribution conclusions to still be valid because cultivated row crop remains the dominant land use in the expanded watershed and the transport mechanism rates are unchanged based on literature values.

While the loading capacity is defined for multiple stream flow conditions in terms of tons per day, DANR described critical conditions in Big Sioux Segments 5 and 6 occurring during the 10-90% flow frequencies (Section 11.0 Critical Conditions). DANR recommends remediation efforts should focus on reducing TSS in segments 5 and 6 segments by implementing best management practices that focus on limiting watershed-scale runoff from moist conditions, mid-range conditions, and dry conditions.

Assessment: The EPA concludes that DANR's loading capacity was calculated using an acceptable approach or water quality model, used observed concentration data and water quality targets consistent with numeric water quality criteria, and has been appropriately set at a level necessary to attain and maintain the applicable water quality standards. The pollutant loads have been expressed as

daily limits. The critical conditions were described and factored into the calculations and were based on a reasonable approach to establish the relationship between the target and pollutant sources.

4. Load Allocation

As described in Section 8.3 (Load Allocations), DANR established a single LA as the allowable load remaining after accounting for the WLA and 10% explicit MOS (i.e., LA = TMDL – WLA – MOS) for each of the two segments. Tables 10 and 11 present the LA across the TMDL's five flow zones for each of the two segments. These composite LAs represent all nonpoint source contributions, both human and natural, as one allocation, however, individual nonpoint source categories were characterized in greater depth in Section 6.2 (Natural and Nonpoint Sources of Sedimentation).

Assessment: The EPA concludes that the LAs provided in the TMDL submittal are reasonable and will result in attainment of the water quality standards.

5. Wasteload Allocations

All NPDES permitted facilities within the segments 5 and 6 watershed were identified and reviewed for WLA consideration in Section 6.1 (Point Sources).

Three point sources were assigned individual WLAs. Segment 5 was assigned a WLA of 0.06 tons/day across all flow zones for the City of Volga's WWTF (#SD0021920). Segment 6 was assigned a WLA of 0.88 tons/day across all flow zones for the City of Brookings WWTF (#SD0023388). These WLA were calculated using a TSS concentration of 45 mg/L, the existing technology-based effluent limit, and the 80th percentile daily maximum flow. Other traditional non-stormwater facilities in the watershed were reviewed and determined to not be sources of TSS.

Both segments 5 and 6 were also given a WLA for the City of Brookings MS4 (#SDR41A003). To calculate the WLA assigned to the City of Brookings MS4, the jurisdictional area approach was used. The MS4 covers approximately 2.91% of the segment 5 watershed area and 2.1% of the area that drains to the segment 6 watershed. These area percentages were applied to the equation displayed in Section 6.1.2 (City of Brookings MS4) to calculate the MS4 WLAs across different flow zones (i.e., [TMDL – WLA – MOS] * $Area_{MS4}$ = MS4 Load).

There are eight permitted CAFOs in the segments 5 and 6 watershed. CAFOs were not assigned a WLA in the TMDL given they are not permitted to discharge their waste in accordance with provisions of their NPDES permits. Thus the WLA assigned to CAFOs was set at zero in all five flow zones for both segments of the Big Sioux River.

Given that construction permits must have coverage and comply with South Dakota's General Permit Authorizing Stormwater Discharges Associated with Construction Activities, the TMDL assumes the permittees' TSS contribution will be minimal, and unless found otherwise, no additional permit

conditions are required by this TMDL. Therefore, A WLA of zero was assigned to each construction stormwater permittee in the segments 5 and 6 TMDL.

Assessment: The EPA concludes that the WLAs provided in the TMDL are reasonable, will result in the attainment of the water quality standards and will not cause localized impairments. The TMDL accounts for all point sources contributing loads to impaired segments, upstream segments and tributaries in the watershed.

6. Margin of Safety

A 10% explicit MOS was calculated within the duration curve framework to account for uncertainty (e.g., loads from tributary streams, effectiveness of controls, etc.). This 10% explicit MOS was calculated from the TMDL within each flow zone. The remaining assimilative capacity was attributed to nonpoint sources (LA) or point sources (WLA).

Assessment: The EPA concludes that the TMDLs incorporate an adequate margin of safety.

7. Seasonal Variation

The load duration curve method used to establish the TMDL incorporates variations in stream flow, which in turn, is influenced by other climatic and human factors that change throughout the year. To account for these variations, DANR developed the TMDL at five different flow zones as listed in Table 10 and 11. The monthly variability of monitored TSS concentrations is summarized in Section 10.0 (Seasonality). July exhibited the highest median TSS concentrations, however, exceedances of the TMDL target were observed across late spring and summer months.

Assessment: The EPA concludes that seasonal variations were adequately described and considered to ensure the TMDL allocations will be protective of the applicable water quality standards throughout any given year.

8. Reasonable Assurances

The Big Sioux TSS TMDLs are developed for two assessment units impaired by both point and nonpoint sources, thus reasonable assurances are provided. For point sources, all WLAs will be implemented through the NPDES permitting process. The WLAs for the City of Volga and Brookings WWTFs were both established based on a TSS concentration that is stricter than the TMDL target (i.e., 45 mg/L vs. 90 mg/L) and the 80^{th} percentile daily maximum flow, which is more conservative than using design capacity flow. The existing effluent limit of 45 m/L is a technology-based limit for secondary treatment standards.

Additionally, the MS4 WLAs appear reasonable. As calculated in Appendix C, DANR estimated the current MS4 TSS contribution as 0.572 tons/day to segment 5 and 0.465 tons/day to segment 6. While these runoff estimates are calculated as average daily loads and do not directly correspond to flow

zones, the analysis would suggest that the MS4 is already meeting WLAs the majority of the time (MS4 WLAs range from 0.0888 to 30.2 tons/day), except during the low flow zones where an average daily value likely overestimates actual runoff. Also of note, the MS4 existing loads and WLAs account for only a small fraction of the total allowable loading (~2%).

Supporting nonregulatory, voluntary-based reasonable assurance for nonpoint sources, DANR recognizes in Section 12.0 (Water Quality Improvement Plan and Monitoring Strategy) that to ensure attainment of the TMDL, Best Management Practices (BMPs) will need to be implemented. Additional monitoring and evaluation efforts will be targeted toward the effectiveness of implemented BMPs. DANR includes the recommendation of specific activities and geographic areas to focus implementation, which are discussed in Section 12.2 (Implementation).

The submittal discusses DANR's adaptive management approach Section 12.3 (Adaptive Management) which allows DANR to adjust the LA and/or WLA allocations in this TMDL to account for new information or circumstances identified during the implementation of the TMDL. If a review of the new information or circumstances indicates that an adjustment to the LA and WLA is appropriate, then the TMDL will be updated following DANR programmatic steps including public participation and submission to EPA for review and approval.

Assessment: The EPA considered the reasonable assurances contained in the TMDL submittal and concludes that they are adequate to meet the load reductions. Nonpoint source load reductions are expected to occur through the implementation of best management practices as described in the incentive and voluntary program plans in place, in progress or planned to begin in the near future. Point sources with NPDES permits require that effluent limits are consistent with assumptions and requirements of WLAs for the discharges in the TMDL.

9. Monitoring Plan

In Section 12.1 (Monitoring Strategy), DANR mentions that long-term monitoring will continue for segments 5 and 6 as part of DANR's ambient water monitoring program at WQM station 460662 and 460702, respectively. In addition, East Dakota Water Development District (EDWDD) will continue monitoring at both stations through internal project means and through the efforts of future Rotating Basin Project Partnerships. Sampling is expected to continue indefinitely dependent on resource availability and funding. USGS staff will continue to maintain the continuous stream gage identified as 06480000 so long as it is appropriate. Additional monitoring will be focused on the effectiveness of implemented BMPs. Collectively, these data will be used to judge progress towards achieving the goals outlined in the TMDL. This submittal is not considered a phased TMDL.

Assessment: The TMDL submittal includes a long-term monitoring commitment. The EPA supports these future monitoring plans and recommends the state consider additional monitoring to track overall progress of TMDL implementation.

10. Implementation

In Section 12.2 (Implementation), DANR mentions that watershed-scale implementation projects can be accomplished by using financial and technical assistance through DANR. Financial support is administered to implementation projects aiming to protect and improve the water quality in South Dakota. DANR administers several major funding programs that provide low interest loans and grants for projects that protect and improve water quality in South Dakota. Funding provided by DANR includes the Consolidated Water Facilities Construction program, Clean Water State Revolving Fund (SRF) program, Section 319 Nonpoint Sources Management Program, and the South Dakota Legislature House Bill 1256 Program (Riparian Buffer Initiative Program).

Working with current 319 implementation projects such as the Big Sioux River Implementation Project and the Prairie Coteau Watershed Improvement and Protection Project provides collaborative solutions for reducing sediment in the Big Sioux River. An educational project, Soil Health Planning and Improvement Project, provides educational outreach programs to producers to help maintain healthy soil through practicing the five soil health principles. Additionally, the City of Brookings has established a Brookings Master Drainage Plan in 2008 in an effort to make improvements to the City's stormwater infrastructure which will aid in maintaining and improving water quality. Lastly, DANR recommends eight different practices to reduce sediment-laden runoff from row crops, which the TMDL identifies as the primary contributing source of TSS to these segments of the Big Sioux River.

Assessment: DANR discussed how information derived from the TMDL analysis process can be used to support implementation of the TMDLs. The EPA is taking no action on the implementation portion of the TMDL submittal because implementation plans are not a required TMDL element.

11. Public Participation

Section 12.4 (Public Participation) explains the public engagement process DANR followed during development of the TMDL. A draft TMDL report was released for public comment from August 22nd, 2024 to September 28th, 2024. The opportunity for public review and comment was posted on DANR's website and announced in two area newspapers. The final TMDL inadvertently left placeholder information describing the public notice process. However, EPA confirmed the details above with DANR. One member of the public provided comments and DANR provided responses to their comments, which is recorded in Appendix E.

Assessment: The EPA has reviewed the state's public participation process, the summary of significant comments received and DANR's responses to those comments. The EPA concludes that the state involved the public during the development of the TMDL, provided adequate opportunities for the public to comment on draft documents and provided reasonable responses to the comments received.

12. Submittal Letter

A transmittal letter with the appropriate information was included with the final TMDL report submission from DANR on December 3rd, 2024 and signed by Alan Wittmuss, Environmental Scientist Manager-TMDL Team Leader, Water Protection Program.

Assessment: The EPA concludes that the DANR's submittal clearly and unambiguously requested the EPA to act on the final TMDLs in accordance with the Clean Water Act and the submittal contained all the necessary supporting information.

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